



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

### Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

### About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

WIDENER LIBRARY



HX HSTF A

TWELFTH  
VERMONT AGRICULTURAL REPORT

BY THE  
STATE BOARD OF AGRICULTURE,  
FOR THE  
YEARS 1891—92

W. W. COOKE,

SECRETARY OF THE BOARD.



BURLINGTON :  
FREE PRESS ASSOCIATION  
1892.

Sci 1644.2



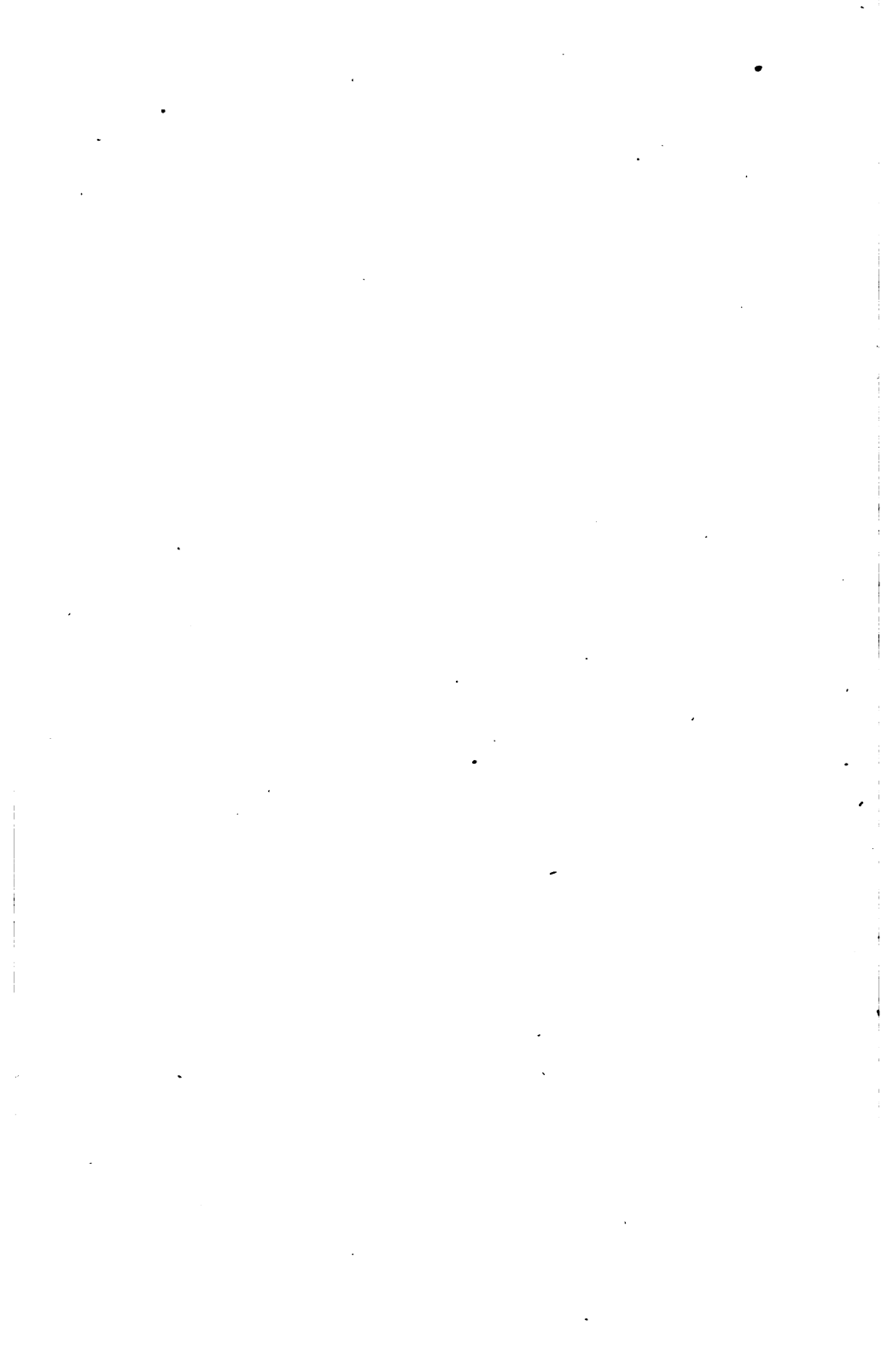
Harvard College Library

FROM

*the Vermont  
State Library.*

*4 Oct 1893.*





©  
TWELFTH

512.20  
C(I.p. 296)

VERMONT  
AGRICULTURAL REPORT

BY THE

STATE BOARD OF AGRICULTURE,

FOR THE

YEARS 1891-92.

---

W. W. COOKE,

SECRETARY OF THE BOARD.



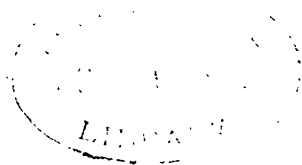
BURLINGTON :

FREE PRESS ASSOCIATION, PRINTERS AND BINDERS.

1892.

~~512.20~~

Sci 1644.2



Vermont State Library.

## TABLE OF CONTENTS.

---

BOARD AND FERTILIZER LAWS.

REPORT OF THE SECRETARY OF THE BOARD.

AGRICULTURAL INSTITUTES.

DISCUSSIONS AT SAME.

ADDRESSES BY INVITED PARTIES.

ADDRESSES BY MEMBERS OF THE BOARD.

**MEMBERS**  
OF THE  
STATE BOARD OF AGRICULTURE.  
1891--92.

HIS EXCELLENCY, CARROLL S. PAGE, Hyde Park, *Chairman.*

MATTHEW H. BUCKHAM, Pres. State Agricultural College,  
Burlington.

W. W. COOKE, Burlington, *Secretary of Board.*

R. C. SMITH, Pittsford, (P. O. Address, Florence).

H. W. VAIL, Pomfret.

WILLIAM CHAPIN, Middlesex.

J. O. SANFORD, Stamford.

VICTOR I. SPEAR, Braintree.

•



# FORMER MEMBERS

## OF THE

# STATE BOARD OF AGRICULTURE.

1871-72.

His Excellency, JOHN W. STEWART.

JAMES B. ANGELL, President State Agricultural College.

PETER COLLIER, Secretary of the Board.

A. B. HALBERT, Essex.

CHARLES H. HEATH, Plainfield.

FREDERICK HOLBROOK, Brattleboro.

PITT W. HYDE, Castleton.

Z. E. JAMESON, Irasburgh.

NOAH B. SAFFORD, W. R. Junction.

1873-74.

His Excellency, JULIUS CONVERSE.

MATTHEW H. BUCKHAM, Pres. State Agricultural College.

PETER COLLIER, Secretary of the Board.

A. B. HALBERT, Essex.

CHARLES H. HEATH, Montpelier.

FRANCIS D. DOUGLAS, Whiting.

PITT W. HYDE, Castleton.

Z. E. JAMESON, Irasburgh.

THOS. H. HOSKINS, Newport.

1875-77.

His Excellency, ASAHEL PECK.

MATTHEW H. BUCKHAM, Pres. State Agricultural College.

PETER COLLIER, Secretary of the Board.

THOMAS L. SHELDON, Rupert.

ALEXIS T. SMITH, New Haven.

JOHN B. MEAD, Randolph.

C. HORACE HUBBARD, Springfield.

GARDNER S. FASSETT, Enosburgh.

CYRUS G. PRINDLE, Charlotte.

JOHN H. MEAD, West Rutland.

1877-78.

His Excellency, HORACE FAIRBANKS.

MATTHEW H. BUCKHAM, Pres. State Agricultural College.

HENRY M. SEELY, Secretary of the Board.

GARDNER S. FASSETT, Enosburgh.

PETER COLLIER, Burlington.

ALBERT CHAPMAN, Middlebury.

JOHN H. MEAD, West Rutland.

ORA PAUL, Pomfret.

HENRY CHASE, Lyndon.

1879-80.

Under change of law, JOHN B. MEAD, of Randolph, was "Superintendent of Agriculture Affairs."

1881-82.

His Excellency, ROSWELL FARNHAM.

MATTHEW H. BUCKHAM, Pres. State Agricultural College.

HIRAM A. CUTTING, Secretary of the Board.

HENRY LANE, Cornwall.

E. M. GOODWIN, Hartland.

M. W. DAVIS, Westminster.

H. F. LOTHROP, Pittsford.

GARDNER S. FASSETT, Enosburgh.

E. R. TOWLE, Franklin.

E. R. PEMBER, Wells.

1883-84.

His Excellency, JOHN L. BARSTOW.  
 MATTHEW H. BUCKHAM, Pres. State Agricultural College.  
 HIRAM A. CUTTING, Secretary of the Board.  
 HENRY LANE, Cornwall. | E. R. PEMBER, Wells.  
 E. M. GOODWIN, Hartland. | E. R. TOWLE, Franklin.  
 M. W. DAVIS, Westminster.

1885-86.

His Excellency, SAMUEL E. PINGREE.  
 MATTHEW H. BUCKHAM, Pres. State Agricultural College.  
 HIRAM A. CUTTING, Secretary of the Board.  
 HENRY LANE, Cornwall. | E. R. TOWLE, Franklin.  
 M. W. DAVIS, Westminster. | F. D. DOUGLAS, Whiting.  
 A. E. PERKINS, Pomfret.

1887-88.

His Excellency, EBENEZER J. ORMSBEE.  
 MATTHEW H. BUCKHAM, Pres. State Agricultural College.  
 W. W. COOKE, Secretary of the Board.  
 HENRY LANE, Cornwall. | H. H. HILL, Isle LaMotte.  
 M. W. DAVIS, Westminster. | R. C. SMITH, Pittsford.  
 D. L. CUSHING, QUECHEE. | H. W. VAIL, Pomfret.  
 WILLIAM CHAPIN, Middlesex.

1889-90.

His Excellency, WILLIAM P. DILLINGHAM.  
 MATTHEW H. BUCKHAM, Pres. State Agricultural College.  
 W. W. COOKE, Secretary of the Board.  
 M. W. DAVIS, Westminster. | H. W. VAIL, Pomfret.  
 R. C. SMITH, Pittsford. | WM. CHAPIN, Middlesex.  
 C. M. WINSLOW, Brandon.

## AN ACT ESTABLISHING THE VERMONT BOARD OF AGRICULTURE.

*It is hereby enacted by the General Assembly of the State of Vermont:*

SEC. 1. The Governor of the State, the President of the University of Vermont and State Agricultural College, and six other persons appointed by the Governor and confirmed by the Senate, who shall hold their offices until the first day of December in that year in which the regular biennial session of the General Assembly occurs next after their appointment, shall constitute the Vermont Board of Agriculture, for the improvement of agriculture and the general interests of husbandry, and the promotion of agricultural education throughout the State. In case of vacancy in the Board by reason of death, resignation, or removal from the State of any member, or from any other cause, the Governor shall fill the vacancy by appointments as in other cases.

SEC. 2. The members of the Board shall receive two dollars per day each and their expenses necessarily incurred in the discharge of duties. They shall designate one of their number who shall serve as Secretary, and the entire expense of the Board shall not exceed twenty-five hundred dollars annually.

SEC. 3. The Board shall hold one meeting in each county in this State annually, and may hold as many more as it shall deem expedient, either independently or in connection with any society, association or other organization devoted to the same general object, and may, in its discretion, employ lecturers, essayists, or other aids in the conducting of its affairs, and shall, as far as may be practicable, aid and encourage State and local associations and societies.

SEC. 4. The Secretary shall prepare on or before the thirty-first of July of that year in which the regular biennial session of the General Assembly is held, a detailed report of the proceedings of the Board, with such suggestions and recommendations as the interests of agriculture may require, and may append thereto such

abstracts of the proceedings of the several agricultural societies, dairymen's associations and farmers' clubs in the State as the Board shall deem advisable. The report shall be printed in such manner as the Board shall direct and such number as they shall deem advisable, five hundred copies of which shall be for the use of the State Librarian and General Assembly, and the remainder shall be distributed under the direction of the Board. The expense of printing the report shall be included in the appropriation made in section two of this act.

SEC. 5. An act entitled "An act establishing a State Superintendent of Agricultural Affairs," approved November 26, 1878, is hereby repealed.

SEC. 6. This act shall take effect from its passage.

Approved December 23, 1880.

---

NO. 170.—JOINT RESOLUTION RELATING TO THE DUTIES OF THE BOARD OF AGRICULTURE.

*It is hereby resolved by the Senate and House of Representatives:*

That the Board of Agriculture are hereby directed to make the subject of forestry, including the planting of forest trees on the worn out or waste and rocky lands in this State, and the improvement and protection of all forests, one of the topics of instruction in their meetings among the people of Vermont, and that the discussions as to the best methods and measures to promote these objects shall be had, in view of the condition of affairs in each section of the State, as they meet there.

E. J. ORMSBEE,

*President of the Senate.*

JAMES K. BATCHELDER,

*Speaker of the House of Representatives.*

NO. 99.—AN ACT RELATING TO THE STATE BOARD OF  
AGRICULTURE.

*It is hereby enacted by the General Assembly of the State of Vermont :*

SEC. 1. Section one hundred and seventy-seven (177) of chapter sixteen (16) of the Revised Laws, is hereby amended by striking out the word "two" in the first line and inserting in lieu thereof the word "three."

SEC. 2. Section one hundred and seventy-nine (179) of the above mentioned chapter and Revised Laws, is hereby amended by striking out all of said section after the word "advisable" in the eighth line, and inserting in lieu thereof the following :

Four thousand copies of said report shall be printed, and the same shall be State printing to be contracted for under the provisions of act number 160 of the acts of 1884, and paid for like other State printing. Five hundred copies of said report shall be for the use of the General Assembly and the State Librarian, and the remainder shall be distributed to the people of the State under the direction of the Board of Agriculture.

SEC. 3. This act shall take effect from its passage.

Approved November 27, 1888.

## FERTILIZER LAW.

*It is hereby enacted by the General Assembly of the State of Vermont :*

SEC. 1. Every lot or parcel of commercial fertilizers, or material used for manurial purposes, sold, offered or exposed for sale in the State of Vermont, the retail price of which is ten dollars or more per ton, shall be accompanied by a plainly printed statement clearly and truly certifying the number of net pounds of fertilizer in a package, the name, brand or trade-mark under which the fertilizer is sold, the name and address of the manufacturer or importer, the place of manufacture, and a chemical analysis stating the percentage of nitrogen or its equivalent in ammonia, of potash soluble in distilled water, and of phosphoric acid in available form soluble in distilled water, and reverted, as well as the total phosphoric acid. In case of those fertilizers which consist of other and cheaper materials, said labels shall give a correct general statement of the composition and ingredients it accompanies.

SEC. 2. Before any commercial fertilizer, the retail price of which is ten dollars or more per ton, is sold, offered or exposed for sale, the importer, manufacturer or party who causes it to be sold, or offers it for sale within the State of Vermont, shall file with the Director of the Vermont Agricultural Experiment Station a certified copy of the statement named in section one of this act, and shall also deposit with said Director, at his request, a sealed jar, glass or bottle containing not less than one pound of the fertilizers, accompanied by an affidavit that it is a fair average sample thereof.

SEC. 3. The manufacturer, importer or agent of any commercial fertilizer or material used for manurial purposes, the retail price of which is ten dollars or more per ton, shall, before the fertilizer is offered for sale, obtain a license from the State Treasurer, countersigned by the Director of the Vermont Agricultural Experiment Station, authorizing the sale of the same in the State, and shall securely affix to each barrel, bag or other package of fertilizer the word "Licensed," with the number and date of the license. The

manufacturer or importer obtaining such license shall pay to the State one hundred dollars for such license, and the license shall expire on the thirty-first day of December of the year for which it is issued. One license shall cover all brands manufactured by any one manufacturer, corporation or company.

SEC. 4. Manufacturers and importers of commercial fertilizers sold or offered for sale, the retail price of which is ten dollars or more per ton, shall, before such fertilizers are sold, offered or exposed for sale, file with the State Treasurer a bond, with sureties residing within the State, satisfactory to said Treasurer, in the sum of one thousand dollars, payable to the State and conditioned for the payment of forfeitures and costs imposed on such manufacturers and importers for violating the provisions of this act, and such bond shall be renewed from time to time, as the State Treasurer may require.

SEC. 5. The term "commercial fertilizer," as used in this act, shall be taken to mean compounds and manufactured substances containing or represented as containing, two or more ingredients mentioned in section one of this act, but shall not apply to the separate ingredients used to manufacture the same, or to bone-meal, land plaster, lime or any substance the product of nature which has not been compounded.

SEC. 6. No person shall sell, offer or expose for sale, in the State of Vermont, any pulverized leather, raw, steamed, roasted or in any form as a fertilizer, or as an ingredient of any fertilizer or manure, without an explicit printed certificate of the fact, said certificate to be conspicuously affixed to every package of such fertilizer or manure, and to accompany or to go with every parcel or lot of the same.

SEC. 7. Any person selling, offering or exposing for sale, any commercial fertilizer, without the statement required by section one of this act, or with a label stating that said fertilizer contains a larger percentage of any one or more of the constituents mentioned in said section than is contained therein, or respecting the sale of which all of the provisions of the foregoing sections have not been fully complied with, shall forfeit fifty dollars for the first offence and one hundred dollars for each subsequent offence. This section

shall not effect parties manufacturing, importing or purchasing fertilizers for their own use and not for sale in this State.

SEC. 8. All manufacturers and importers of commercial fertilizers, or wholesale dealers in the same, shall, not later than February first, furnish the Director of the Vermont Agricultural Experiment Station with a complete list of the brands and of agents selling, offering or exposing for sale, such fertilizers, and on the first of each succeeding month till May first such additional agents or dealers as in the mean time have been appointed.

SEC. 9. The Director shall cause one analysis or more of each fertilizer or material used for manurial purposes to be made annually and the result published monthly. Said Director is hereby authorized, in person or by deputy, to take a sample not exceeding two pounds in weight for analysis from any lot or package of fertilizer, or any material used for manurial purposes, which may be in the possession of any manufacturer, importer, agent or dealer; but said sample shall be drawn in the presence of said party or parties in interest, or their representatives, and shall be taken from a parcel or number of packages which shall not be less than five of the whole lot inspected, and shall be thoroughly mixed and then divided into two equal samples and placed in glass vessels, carefully sealed, and a label placed on each stating the name of the brand of the fertilizer or material sampled, the name of the party from whose stock the sample was drawn and the time and place of drawing, and said label shall be signed by the Director or his deputy and by the parties or party in interest, or their representatives present at the drawing and sealing of said samples; one of said duplicate samples shall be retained by the Director and the other by the party whose stock was sampled. The Director of the Vermont Agricultural Experiment Station shall notify the State Treasurer of all violations of this act and the State Treasurer shall commence a suit, in the name of the State, on the bond required to be filed by such manufacturer or importer, and prosecute the same to final judgment. It shall be the duty of the Treasurer upon ascertaining any violations of this act, to forthwith notify the manufacturers and importers, in writing, and give them not less than thirty days thereafter, in which to comply with the requirements of this act.



But there shall be no prosecution in relation to the quality of the fertilizer or fertilizing material, if the same shall be found to be substantially equivalent to the statement of analysis made by the manufacturers or importers.

SEC. 10. The term importer, for all the purposes of this act, shall be taken to mean all who procure or sell fertilizers made in other states.

SEC. 11. Number one hundred and nineteen of the acts of 1882, and number eighty-nine of the acts of 1884 are hereby repealed.

SEC. 12. This act shall take effect January 1st, 1889.

Approved November 27, 1888.

# REPORT OF THE SECRETARY.

---

*To the Chairman and Members of the Board of Agriculture of the State of Vermont :*

The Secretary herewith submits the following report of the work of the Board for the years 1891-92. This has consisted largely of holding Institutes in the various counties as provided by law, and also in connection with the "Dairymen's Association," Farmers' Clubs and the State Grange. Most of the Institutes have been full two days' meetings, but in a few instances less time has been given. At these Institutes and elsewhere the addresses and discussions have been mostly connected with agriculture, and always possessed an agricultural interest.

By the requirements of the law we were to hold two meetings in each county since our last report, and as many more as we could do with the limited fund under our control. Such other Institutes have been held where there was the most urgent demand for them, or where we thought they would do the most good.

The following meetings have been held during the two years :

Swanton.....	Dec. 9 and 10, 1890
Enosburgh Falls.....	Dec. 11 and 12, "
Irasburgh.....	Dec. 16 and 17, "
Craftsbury.....	Dec. 18 and 19, "
Jeffersonville .....	January 6 and 7, 1891
Morrisville.....	January 8 and 9, "
Isle La Motte.....	January 12 and 13, "
Guildhall.....	January 20 and 21, "
Ryegate.....	January 22 and 23, "
Williston.....	January 27 and 28, "
Weybridge.....	January 29 and 30, "
Fair Haven.....	February 3 and 4, "
Wallingford.....	February 5 and 6, "
Wilmington.....	February 10 and 11, "

---

Pownal .....	February 12 and 13, 1891
Springfield.....	February 18 and 19, "
Topsham .....	February 23, "
North Thetford .....	February 24 and 25, "
Braintree.....	February 26 and 27, "
Cabot.....	March 10 and 11, "
Grand Isle.....	October 14 and 15, "
Island Pond.....	December 8 and 9, "
South Troy.....	Dec. 10 and 11, "
Greensboro.....	Dec. 15 and 16, "
Danville.....	Dec. 17 and 18, "
Bakersfield .....	Dec. 29 and 30, "
Hyde Park.....	Dec 30 and 31, "
Chelsea.....	January 5 and 6, 1892
Brookfield.. ..	January 7 and 8, "
Westminster.....	January 14 and 15, "
Calais.....	January 19 and 20, "
Waitsfield.....	January 21 and 22, "
Charlotte .....	January 26 and 27, "
Bristol .....	— January 28 and 29, "
Benson .....	Feb. 2 and 3, "
Pittsford.....	Feb. 3 and 4, "
Rupert.....	Feb. 9 and 10, "
Pownal.....	Feb. 10, "
Wilmington.....	Feb. 11, "
Stamford.....	Feb. 11 and 12, "
Andover.....	Feb. 16 and 17, "
West Hartford.....	Feb. 18, "
Pomfret.....	Feb. 19, "

The papers presented at these meetings and the discussions that followed them form the bulk of this report.

For the past six years the personnel of the Board has not been much changed, and the general line of work has been about the same. It is gratifying to the members to note from year to year the increased interest in the meetings. Anyone who carefully contrasts the discussions of the past winter with those of even six years ago cannot fail to see that the knowledge of the farmers concerning

their calling has largely increased. There is no doubt that these meetings have done much good, and there is a wide field of usefulness for them in the future.

As noted more in detail later in this Report, the Board during the past two years has undertaken some work in the line of letting the world know the attractions of Vermont for the farmer and the manufacturer from the business point of view and its attractions to any one and every one as a good place to live in and to educate one's family. The first year's work was so decidedly successful and was so well received by the people of the State that much the same was repeated the following year. There can be little doubt but that great good will come and much already has come as the result of these efforts. Special credit for the success of the scheme should be given to Mr. Victor I. Spear, of Braintree, member of the Board of Agriculture, on whom fell the larger part of the labor of preparation and publication, and who has given largely of his time and strength to the work.

It would seem that the value of such a method of showing the advantages of Vermont has been sufficiently demonstrated to warrant the next Legislature in taking special action for its continuance.

W. W. COOKE,

*Secretary of the Board.*

## INSTITUTES.

Under this heading is gathered the reports of the several meetings, more especially of the discussions that have followed regular lectures. The lectures are given in full further on in this volume. These discussions have been arranged in topics for easy reference.

---

### ATTRACTIONS OF VERMONT.

---

#### GREENSBORO INSTITUTE.

At the farmers' meeting at Greensboro, Mr. Spear spoke on "The Attractions of Vermont." Our excuse for introducing this subject is : There is a feeling among our people of unrest and dissatisfaction, and that other sections offer greater advantages to young men than Vermont. This feeling has encouraged our young people to go away and every new country has had its help from our State, and many of the latter go from here and are glad to work back and are doing so to a greater or less degree. There has been a feeling growing that the State would have to be turned over to its original forests. Westerners have a faculty of making people believe that theirs is the best part of the world, while Vermonters have been too willing to admit our disadvantages and too free to speak about them. This has been seen in the home and the children reared under this doctrine naturally look outside of Vermont to find a more prosperous country to establish their homes. With this condition of affairs I have taken some pains to look up statistics and find out what kind of a standing Vermont has with other States.

While we have not been in the habit of estimating Vermont very highly as an agricultural State we find that as a corn-growing State she stands second in the number of bushels of corn per acre ; also the same with buckwheat, fifth with oats, third with potatoes and fifth with barley. No other State compares with all the States like Vermont, and as to maple sugar she stands at the head. These

figures show Vermont to be quite a State agriculturally. In horses our State stands well and if Vermonters had attended to their opportunities she would have been at the head for the basis of good breeding in other States has been the choice mares taken from Vermont. In sheep it is conceded that Vermont has the finest Spanish merino sheep in the world. We imported a sheep here from Spain that would shear from five to seven pounds and Vermont skill, climate, feeding and breeding has brought it up to the high type of the Vermont merino of the present day. More money has been brought into the State from this industry in proportion to the capital invested than from any other source.

In the dairy business we are only about twenty-five years old, yet at Paris, Vermont carried off the first prize on butter in competition with the whole world. These things could not be possible unless our feeds were rich and our climate such as to give constitution and vigor and the fullest development to both men and animals.

Our markets for all kinds of crops are superior. In the West corn, wheat, beef and pork are the only crops sold. I have many letters from Western people stating that they want to come East where there is a market for all that the farm produces. We should encourage manufacture. We have just commenced to know the resources of our State. One county in the State is producing an enormous quantity of marble and working 4,000 men. What is now being done is simply a beginning of what is possible in this direction. Granite has made Barre a large manufacturing centre and twenty-five other towns could supply a like amount. Slate is another large source of wealth of which like our granite and marble the supply is inexhaustable. Heretofore two towns have manufactured nearly all the slate, but many towns have a large supply. It is of particular interest to Vermont farmers to encourage these industries. It is no worse for Vermonters to invest at home and lose than to send their money West and lose. If we lose we have the satisfaction of knowing were it goes. The capital we have sent West would put a mill on every stream, and we to-day would be giving employment to a million people. Manufacturers are working this way. In the past eight years five or six boot and

shoe factories have been built on the White river and its branches. Our climate is suitable, men do more work and we are away from the influence of strikes and labor troubles.

New Hampshire has advertised her attractions and the money brought into the State by summer tourists exceeds the money value of all her agricultural products. Why cannot Vermont do the same? Surely we have as beautiful scenery, good fishing and hunting and easy means of transportation. No State can excel us. Our railroads did a little advertising last summer and largely increased their business, and it is necessary that every one should look to our peculiar advantages.

Business in the State is increasing. The past year has been one of progress and has witnessed the up-building of several new industries. We believe our statistics will show an increase in labor employ of 4,000 or 5,000 persons.

#### BROOKFIELD INSTITUTE.

Mr. A. S. Allis said he wanted to express his approval of the course the Board of Agriculture had taken in disposing of their excess of funds in advertising the advantages of Vermont. He said he thought it a wise course to pursue and that great good would result from it, and he moved that this meeting by a rising vote should express their approval of the action of the Board; also thanking them for the very instructive pamphlet they had issued, firmly believing every true Vermonter could see wisdom in the course they had taken. The motion was unanimously carried.

## BREEDING DAIRY STOCK.

---

### BROOKFIELD INSTITUTE.

Mr. Chapin said in regard to the rearing of young stock that the first consideration should be : What do we raise them for ? What do we wish to do with them after they are grown ? If I am breeding for the dairy to make butter, then take some of the butter breeds such as the Jerseys or Guernseys ; if for beef then take the Durham or Hereford ; if for oxen the Devons. I should prefer pure breeds or high grades. In raising calves never let the calf run with the dam ; if it never sucks it will learn to drink much easier. The care of the mother before as well as after the birth of the offspring is of the utmost importance in any kind of stock. A healthy off-spring rarely follows an ill-kept or overworked dam. The Morgan horse, once the pride and glory of our State should not be overlooked, and should be bred for what is wanted. Do not think it is necessary that everyone should raise trotters; an all purpose horse is what we want.

.

### CRAFTSBURY INSTITUTE.

“Stock Breeding,” by Homer W. Vail, of Pomfret, was the subject under discussion. Mr. Vail said it was a subject of interest to every farmer in the State and should be as much a subject of study and thought as the crops we raise or the manner of feeding. It is a fact that animals bred for a special purpose are of greater value than those not so bred. The principal of breeding from the best is regarded by all breeders of stock to be of the greatest importance. All our improved animals have been bred from wild stock and the different breeds of horses and dogs are a striking example of the different directions they will take by different feeding, breeding and the influence exerted by the circumstances with which they are surrounded. Dogs springing from the same common parentage have been bred in such different directions that the most distinct breeds have been established.



The perpetuation of individual characteristics is influenced very much by care and feed. As an example of this Mr. Vail called attention to the Shetland pony and the Clydesdale horse, both undoubtedly springing from the same common parentage. Producers of beef animals have learned that their animals must be well fed or they will gradually revert. Another very important element is not to lose sight of the fact that developed sires and dams have a great influence on their progeny. As an example of this Mr. Vail mentioned some of our fastest horses and most phenomenal cows. Well bred animals are artificial animals; that is very materially changed from the natural channel of their existence. Line, or in and in breeding, perpetuates the leading characteristics whether good or bad, and in support of this he also named some of our best performing horses, also some of our greatest producing cows.

Mr. Stephen Smith of Craftsbury, said he had more faith in care and feed than in breed. Thinks he can take native cows and do as well with them as with the Jerseys or any other breed. Commenced farming 40 years ago and has the same breed of cows now as then. Would take a two-year-old heifer and have her come in in April; would milk her himself for ten months during the year at regular hours, and never failed in making a good cow. Made 250 lbs. of butter per cow last season. Think there is a great deal in treatment and training, and think the average native cows ought to produce 200 lbs. of butter.

Mr. Vail said: Nothing is better established than that the milking functions are dependent upon the nervous system; referred to the dairy of Mr. Skinner of Tunbridge who produced 400 pounds of butter per cow, by no extra feed but by extra care.

Mr. Smith asked how Mr. Vail fed his cows. Answer: Cut hay and ensilage with about four quarts of bran, and  $1\frac{1}{2}$  pint cotton seed. My cows with quite a per cent of two-year-old heifers are giving about 20 pounds of milk per day and the milk will make an ounce of butter to a pound of milk.

Stephen Smith said: We feed no ensilage; cows come in in April, use forage grain, oats and corn, and would like to feed a peck of carrots a day to cows during the winter.

Mr. Sanford of the Board said : This subject is of the utmost importance ; have fed carrots and beets extensively, but give my preference to a succulent feed. We do not take pains enough in breeding ; we want to breed for business. Best cow for work is a half-breed Jersey. Every farmer should keep a record ; would not raise any animal that I did not know sire and dam.

Asa Harriman said : Have a herd of Jerseys, some two-year-old heifers, and the whole averaged two years ago 250 pounds per cow, each cow eats \$9 worth of grain. This year we produced from 12 cows 280 pounds per cow. We practice winter dairying ; feed some skimmilk to cows ; think I can get more for the skimmilk fed to cows than to any other stock.

Deacon Dutton said : Have fed a great many turnips to cows and found no ill effects on butter if fed after milking.

#### SPRINGFIELD INSTITUTE.

Mr. J. H. Walker advocated the dehorning of cattle. In the wild state cattle need horns as a means of self defense but in a civilized country it is very different. Cattle with horns seem to know their power and make an exhibit of total depravity noticeable to every herder. More than 100 lives are lost annually and more than 100,000 hogs, horses, sheep and cattle annually lose their lives from the horns of cattle. If every farmer could breed horns off or on as he pleased no one would breed the horns on. The operation in taking them off is not so painful as other surgical operations performed. All agricultural papers advocate hornless cattle. It was the custom in Ireland years ago to saw off the horns.

H. H. Harf of Illinois was the first man this country to saw off horns. He was prosecuted by the courts and his cause sustained. A dehorned bull is shorn of his power and other cattle will eat and drink together like so many sheep. The horn of a six weeks' old calf is a mere cartilage ; if taken off then she grows up a mooley. In older cattle cut close—if cut at the matrix there will be no bleeding of any amount.

Mr. C. Horace Hubbard and Mr. Dill endorsed all Mr. Walker had said and practiced it in their own herds. Mr. Dill was working two yokes of dishorned oxen on his farm and much preferred them to the horned animal.

## BUTTER MAKING.

---

### CALAIS INSTITUTE.

H. N. Hollister, East Montpelier—Have tried to experiment and find the cost of a pound of butter. I have ten cows, three two-year-olds, three three-year-olds and the rest older. I raise my own corn and the mixture I feed is 200 corn and cob meal, 200 bran, 100 cotton seed meal; feed eight pounds of this mixture in two feeds to each cow with 10 pounds of hay, 27 pounds ensilage and four pounds of dry corn fodder. It makes butter cost  $13\frac{1}{2}$  cents per pound, counting the hay at eight dollars a ton, corn and cob meal at \$1.25 per hundred. I sell butter for 25 cents. I water with warm water once a day. I think if young farmers would weigh everything they feed and the products they receive, they would know more.

Mr. Pitkin of East Montpelier said: Feed cows in the morning one half bushel of ensilage with three pounds of grain; at noon a feed of hay. If I feed an extra feed of hay there is no good result. Animals should not be gorged with coarse fodder.

### WESTMINISTER INSTITUTE.

Hon. John Gould of Ohio, the famous dairy authority of the Western Reserve was introduced, and said: It seems like being entirely out of place to instruct butter makers in Vermont. The business of farming has been concentrating on butter making and to be a successful dairyman, a man must now be a specialist, and in so far as he is a specialist will he succeed in dairying. The dairy belt used to be Northern New York, Ohio and southern Michigan. The man and cow constitute the dairy belt, and the man who has the best wife to engineer the business is the one who will succeed the best.

There are five rules only required in dairying, but the average butter maker has about two hundred rules. The essentials are the taking of one element only out of the milk leaving all the others behind. Milk is a complex substance and 100 pounds consist of

87 pounds spring water, five pounds fine sugar, two and a half pounds of the whites of eggs, three and three-fourths pounds of oil, one pound albumen, and three-quarters of a pound of alkali of some sort. Though the chemist may analyze the milk and get just the exact proportion of the ingredient, the cow still has the patent right on the formation of these ingredients into milk.

The art of butter making is the extracting of the pounds of butter fat and leaving behind the other things. A good cow puts in a large amount of butter fat. Breed may influence the production, but individuals are the solution of the question. Every cow has methods and some cows are better than others. The selection of the best butter cows is what constitutes the foundation of success in dairying. No man can tell the breed of a cow that produced a given tub of butter from examining the butter itself. The Jersey can put the color into the product but you can make Jerseys out of your cows by a proper collection of individuals. When the milk is in the pail the butter is half made. It must be formed from good food and of good flavor. Milk should result in butter all alike. The butter fat is lighter than other things and rises. How shall it be set? Three pounds out of every five made in the United States are made in open pans or crocks. But it must be set so as to reduce the temperature as soon as possible.

Some form of separator is the best for no other apparatus will take the fats all out. You can not afford to leave from one to one and a half pounds of butter in each 100 pounds of milk. At 25 cents a pound butter is expensive to feed pigs and calves, when oil meal at three cents a pound answers every purpose. It must be set so that odors cannot get in or you will have to introduce something to overcome the odors taken up, or else take them out by souring the milk. Fancy butter is the high flavored with aroma pronounced. Of the 1,000,000,000 pounds made in the world last year only one-fourth was sold for fine, the next one-fourth was a grade lower, and so on until the last one-fourth was sold as soap grease. That is why dairying don't pay. The five rules which insure success are: One, skim the milk as soon as the cream is well up. Souring the milk adds nothing to the cream. Second, churn at the point of slight acidity and develop this acidity by warming the cream to from 70 to 75 degrees, after-

ward letting the temperature drop and you will get your butter without trouble. Third, churn in anything that will bring the butter, but not in anything that will make hash of it. Concussion is the thing, the boiling, pouring motion, the natural motion of fluid. When you get the butter to the size of mustard seed you are done churning. Then use water at a temperature of 62 degrees and get a fluid condition. Put in a teaspoonful of salt and you get a perfect separation. When the granular stage is reached your butter is ready to pack. When butter comes in granular stage the gravity is overcome. Keep churning then slowly, until lumps are formed. Then fill your churn full of fresh water with a half teacupful of salt. The idea is to get it so that the butter will rise. Thoroughly mix and it rises. Wash the butter three times until it is absolutely free from buttermilk. With the ordinary way of churning and working there are five pounds of buttermilk in 100 pounds of butter.

How shall we salt? There is no necessity for a butter worker if you have less than 20 pounds. Salt in the churn. There are two ways. One ounce to the pound is sufficient. Some get in more. The brine system is to get each butter globule surrounded with a coating of brine. Use water at 62 degrees, and it gives us perfect salting and a perfect packing butter. Let the brine stay in fifteen minutes or so, then draw out, put in more salt, churn to lumps, then draw out more brine, churn a little more and your butter is ready for packing. Second system. Drain butter as dry as possible. Scatter butter in the churn, put in salt and work in with a wooden fork. Twenty minutes is long enough to let it stay. Churn slowly and draw out brine. If your customers ask for more salt, work it down and salt to taste.

Do not ball any more butter for the general market. The best package yet made is the little six pound spruce pail made here in Vermont. Pack from the churn into the pail, one pound or so at a time so the butter will be dry. Women should always pack butter because of their more delicate touch. Put new muslin over the hand and press gently into the package, but don't pound in with a club any more. Round up the package and cut it off level by drawing a thread through it. Leave it rough on top. Use new muslin cloth for covering. Wet the cloth, but do not

cover with salt paste. Use only dry salt. Put on name, address and weight of butter and tare. Sell but don't hold for a rise; the market value of fresh butter is greater than it will ever be again. Make between October 1 and June 1 and put into market as soon as made. The man who does this is not the one who complains of low prices. Shall we color butter? That depends. Some markets make a difference of eight cents a pound. In that case color it. Use only vegetable color or let the cow eat carrots. The effect is the same.

Do not use much ice. Ice made butter soon spoils. Do not go to extremes; be moderate and remember that most mistakes are due to ourselves. Raising the temperature of milk is always a benefit. Add one quart of water at 110 degrees. If cream is thick at churning, thin with water at 62 degrees, and if there are any lumps strain through a cloth. If the cream is properly cared for white specks are never troublesome. What is known as ripe cream is intermediate. Lactic acid is present in small quantity. Keep your butter at an even temperature of 55 degrees and it will not spoil. Cream will come equally as well sweet as sour. There is no bad effect when cream is raised to 70 degrees for it was 98 degrees to begin with.

Prof. W. W. Cooke of the Vermont Experiment Station then spoke on butter making. He said in substance: In selecting young stock you want to know for what they are to be used. In determining the breed you want to know the composition of milk given by each individual animal. The only thing wanted for butter is fat. Though it makes no difference to the owner what other ingredients the milk may have, it makes a vast difference to the cow. Casein is what draws most heavily on the cow and milk sugar also takes strength. If she puts one pound of fat in 30 pounds of milk she must also put in quantities of casein and milk sugar and it all takes strength. When milk increases in fat it does not increase proportionately in other ingredients. If you want to get butter you want to get the increase of butter fats in as few pounds of milk as possible. In cheese making you want just the opposite. Cows that give rich milk are small in size, and this makes a vast difference in the amount of feed it takes to make a pound of milk. A large cow has a large amount of superfluous

body to provide for. If a large cow makes no more butter than a small one she is making at a loss for a large cow eats more than a small one. The small cow is the one that will put the largest amount of butter fats into the milk with the least amount of food. The individual animal rather than the breed must fulfil the conditions but she must have an ancestry of butter makers behind her. You can not find it in the Durham and Devons.

To make butter successfully the dairyman must know what he is doing. Butter makers have long practiced the open shallow setting and skimmed the milk leaving a large amount of fat in the pan. It has been guess work, and awful guess work. If you divide the milking you will get widely different results. The analysis of each cow's milk is all you need. It needs no knowledge of chemistry but what a farmer can give to it. All must come to testing if they would make butter profitably. Machines will tell you what the value is and do it easily. Weighing is not a difficult task and after a time becomes a second nature, taking no time at all. Footing up the figures will be some trouble, but delegate that to the boy or girl. It may seem something of a chore to do all this but it must be done to make dairying successful. A testing machine can be used for one stage of the process, and by using a tester you can find out how much richness there is in the milk. You would be surprised at the amount of fat wasted in skim milk. You cannot afford to feed this fat to calves and pigs when it is worth 25 cents a pound. In churning you do not know how much you lose in buttermilk. You will find butter milk varying from richer than whole milk down to no fat.

Dairying is carried on with less knowledge than any other business, but when you find out that you are losing butter fats you are in a fair way to change your methods. It is now too soon to advocate the general introduction of the separator but we are rapidly nearing the condition. The separator gets more butter than any other way of handling. The cost is \$125, so it would not pay a man to get one for a few cows. Each man must study his own circumstances and judge for himself. Some persons with 20 cows can do it but others cannot, the difference being in the men. The work of running the separator is not hard but it is monotonous. The price of separators will be less, but they can never do better work

---

than now. They take the butter fat from the milk so clean that a chemical test finds none remaining. The better way is to go into co-operative dairying. Only a small amount is now handled in creameries. The milk of only one cow in fourteen in this State now goes to creameries and about the same to cheese factories. There is a wide field yet for the introduction of that sort of dairying.



## CORN FODDER AND ENSILAGE.

---

### BROOKFIELD INSTITUTE.

In Mr. Smith's talk on "Feeding the dairy cow" he advocates that farmers should raise the grain they feed and use the silo.

Mr. Flagg asked—Do you feed any grain?

Mr. Smith—I do not. It might be fed with profit, but it is doubtful with the present price of grain. I have the basis of coarse fodder correct to feed grain and get good returns. Unless your coarse fodder is of first class quality grain cannot be fed to any animal with profitable results.

Mr. G. W. Nutting—Do you want corn ripe for the silo?

Mr. Smith—Yes. The more perfect the plant when it goes into the silo the better the ensilage when it comes out. Any time from the roasting stage till glazed is all right.

Mr. Martin—How much time do you want to fill a silo?

Mr. Smith—Pay no attention to time. I fill as I would a bag of hay. I put my corn into the silo whole; do not weight it; did not cover this year but would advise a covering of swamp hay put on green just as mown.

Mr. L. Nutting—Did you ever run your corn through a threshing machine?

Mr. Smith—No.

Mr. Nutting—I consider this the cheapest and best way to harvest corn. It cuts the stalks into shreds and shells the corn, smashing the cobs. The stalks can be put into the mow and will pack close. The cattle will eat them all and they are easily handled.

Mr. Smith—I do not know how an average farmer could handle 300 or 400 bushels of green corn just shelled from the cob.

Mr. Nutting—Arrange your corn house with wire screens so the corn can be spread thinly upon them, and it will dry with no trouble.

In answer to a question of how ripe to let oats get for hay, Mr. Smith said—I never cut them quick enough; would commence as

soon as they are fairly headed out or a little before. They ripen very fast and if a large growth the butts become hard and indigestible and will not be eaten readily.

Mr. Graves—How do you cure your green oats ?

Mr. Smith—Just as I would clover. I would prefer to have them stand in the cock twenty-four hours if convenient. I would mow in the afternoon, and the next afternoon just at night turn over. The next morning as soon as the dew is off turn again and in the afternoon begin to draw.

Mr. Nutting—What would be the effect of putting oats into the silo ?

Mr. Smith—I never tried them but should prefer to cure them as hay ; any plant with a hollow stalk is hard to ensilage unless weighted heavily enough to press the air from the stalks.

Mr. Graves—Does it hurt oats to get wet when you harvest them for hay ?

Mr. Smith—Most assuredly. Any crop cut for hay is very much injured by being wet, even the dew injures it.

Prof. Cooke—A very large amount of the sugar and starch is on the outside of the stalk. Water coming in contact with this dissolves it and it is lost.

Mr. Chapin spoke on "Grass vs. corn."—Mr. Chapin said three-fourths of our cleared land was covered with grass and this is the most important crop of the State.

Mr. H. Rood—Did you ever have any experience with irrigating grass land ?

Mr. Chapin—Water is a great dissolver of fertility ; think it would pay where it could be utilized, but never had much experience.

Mr. Rood—Thirty years ago my farm only cut 45 loads of hay. Now I irrigate 30 acres and this year I drew from 10 acres 43 large loads of hay. This piece has been watered 30 years and been ploughed twice. Hay does not cost me \$3 per ton. Timothy grows 4½ feet high. I would not take \$2000 for my water privilege. It costs very little for the care of the ditch. The second crop or rowen is not very good. The soil is clay loam. There is a chemical process by which the water and melting snow draws fertility from the air. Grass is ready to cut by the middle

of June. I use ashes on dry ground, it is the cheapest fertilizer I can buy.

Mr. Graves—What is the value of this hay as compared with other hay?

Mr. Rood—I am no chemist, but my stock does as well on this as on any other hay. It grows thick. I have used ashes by the side of phosphate and both mixed, and get the best results from a mixture.

Mr. Cole—When I can get water on I never use any manure.

Mr. Camp said he would like the experience of others in regard to ashes. It seems that on one side of this view ashes are good and not on the other.

Mr. Cassius Peck—Ashes are a very valuable fertilizer in Braintree, Brookfield and Williamstown.

Mr. H. C. Kidder—My experience with phosphate and ashes on corn is that corn with phosphate was much the best in the forepart of the season, but at harvest I had one-third more from the ashes.

Mr. Graves—I had a lot 30 years ago and thought it valuable on account of the water privileges. I irrigated it four or five years with good results. After that the hay was not so good and I have quit it. The grass seemed to run out. I would not give much for a stream of water; think it can be overdone.

#### CALAIS INSTITUTE.

Mr. Charles Hollister read a paper on "Corn raising." He said: I plow in the fall, about seven inches, and prefer green sward. I apply the manure broadcast, five cords per acre; use a wheel harrow, spring tooth, and smoothing harrow. I plant from 18th to 25th of May and three to four kernels. I apply 300 pounds of phosphate per acre; use a smoothing harrow and Breed's weeder; use these on a bright day. If the land is not very weedy I use no hoe except to cut thistles, docks and plantain. Good walking horse will go over three-quarters of an acre in an hour with Breed's weeder. By keeping a correct account in 1889 I found that I raised two acres of corn that cost, including phosphate and labor, just 13 cents for each basket of ears, making no allowance

for future value of fertilizers. Seed should not be allowed to freeze before thoroughly dry.

Prof. Cooke gave the results of an experiment with corn fodder put in silo and in stooks out of doors, corn cut same time alternating with one in silo and the other in the stook. The stooks were made very large and bound tight they kept in good condition and when fed were cut into one-quarter inch pieces. All were eaten without waste. The experiment began November 1 and ended April 1. One-half cows fed on ensilage four weeks, then the same time on fodder, the other half alternating. The milk was weighed and analyzed in both cases; the cows shrank on feeding corn fodder, and on ensilage about held their own. The corn fodder was in the best of condition, but the ensilage was not. The silo was so large we could not feed over the whole top every day. There was no change practically in the quality of the milk; ensilage was worth nine per cent more than corn fodder.

Mr. Sanford—Is ensilage more digestible than green corn?

Prof. Cooke—Ensilage is not so digestible as green corn, and corn fodder not so digestible as ensilage. In the experiment we also fed some hay; the different cows took from 30 to 80 pounds of ensilage.

#### SPRINGFIELD INSTITUTE.

Hon. C. Horace Hubbard gave a very interesting address on corn raising. Said most of us remember when Vermont raised her own corn. We had all we wanted and used to draw it to Keene and Nashua in exchange for other goods. But now it is very different; have taken some pains to learn how much we buy, and find that at our station we have shipped to us 30 carloads of corn, 10 of oats, and 73 of other feeds, to say nothing of grain bought at other places. Farmers are in the habit of coming to town with money and go home with loads of corn. I believe in raising corn; put work into the soil. It pays to drain the wet places and tile so the cultivating may be uniform. Too much pains cannot be taken in plowing, and the present system of harrowing is of great value. It is best to spread manure in the fall on grass stubbled early in the fall; spread evenly like the manure spreader; very little is lost, as

the water washes the fertility into the soil. Do not like to spread in winter whereit will wash.

I have raised 160 bushel ears of sorted corn to the acre with 800 pounds of Stockbridge manure. On some soils plaster and ashes work well ; always use ashes on potatoes in a backward spring. Phosphate will pay. There are heavy varieties of corn ; I want a good early kind of eight rowed ; do not like the twelve rowed ; want it planted with a machine like the Eclipse ; rows should run north and south. Prefer one stalk once in a foot in the row ; can get more corn that way than if in hills, four spears once in two feet. Corn for ensilage is usually planted too thick. Corn so thickly sown as to be white near the ground is nearly worthless. Commence to cultivate early ; don't use a cultivator that cuts a furrow next to the roots ; don't know about the weeder. Roots of corn grow very fast ; corn two inches high sends out roots four or five inches ; cultivate deep up to June 1 after that light. Believe in killing weeds when small ; go through cornfield with cultivator twice a week till haying. I estimate the cost of raising corn at 28 1-10 cents per bushel. If Springfield with her 240 farms should raise 62 bushels each it would save our buying 15,000 bushels.

#### WILMINGTON INSTITUTE.

Henry Adams—Do you consider corn of more value for ensilage when nearly ripe to put into the silo ?

Mr. Sanford—Ripe corn is the most valuable for the silage. Putting in very green corn that had been sown thickly by those who first fed silage kept many farmers from adopting that method of husbanding their corn ; would plant as for grain.

Mr. Adams—Will the ensilage make as valuable fodder as if put in for grain ?

Mr. Sanford—Corn increases in value 100 per cent from the time it tassels. There is more feeding value in ripe sweet ensilage than in any other way it can be harvested and I estimate the cost of putting it in silo at only 40 cents per ton. Ensilage is rated as being worth one-third as much per ton as good hay.

Mr. Adams—Should a silo be filled quickly or otherwise ?

---

Mr. Sanford—It makes no difference.

Mr. Chapin—In raising crops our artificial work is simply assisting nature, The rain, frost, snow and sun, all have their important part to act; you put manure on an undrained swamp and you get no return, but drain that swamp so the sun can act and you will get a crop.

## CREAMERIES.

---

### SWANTON INSTITUTE.

Prof. W. W. Cooke of Burlington was the first speaker ; subject, "advantages of creameries." One advantage was the large amount of labor saved by having the milk made up at a creamery rather than on the farm. Work can be done cheaper on a large than a small scale. Compare the churning of 300 lbs per day when all is done at one time and in one churn, or by eight or ten batches on as many different farms. Another advantage is in taking the work from the home where the hardest part of it usually falls upon the women. It is too much for a woman to perform, and after she is once accustomed to having the work done away from the farm it is always a hard matter to have it taken back. There is a great difference in the expense of handling milk at home or at the creameries, care of milk, care of cream, etc., all can be done at much less expense and better than on the farm. Creamery butter almost always sells for a larger price than the average dairy butter ; although a few fancy butter makers command a larger price, the average farm dairy sells below the creamery. If all should patronize the creamery, the work would be done much cheaper. The larger the amount of milk taken, the less expense in dairying. In addition to better products we get more butter from the milk.

Co-operative creameries have not usually paid so well as proprietary. We have found the poorest work at the co-operative creameries, and the best in proprietary. Butter makers who work by the pound have not the interest in the work that the proprietor naturally has.

Skim-milk from private dairies will average to contain 0.70 per cent butter fat, while the average in creameries will be less than 0.50 per cent. Thus when 5000 pounds of milk are run per day the difference would amount to enough to pay for making the

butter. Eight and a half pounds of butter fat will make a pound of butter. Can ripen the cream better in large than in small quantities.

Creameries are not an unmixed blessing. There is a great difficulty in getting every one to furnish clean and pure milk. Where a private dairyman is uncleanly in his work he is the only sufferer, but in a creamery his neighbors are likewise injured. The creameryman must have back-bone enough to refuse poor milk. There should be some one delegated to look up the dairies, and demand the utmost cleanliness of every patron.

One difficult problem is to get paid for milk according to its value, as there is a great difference in the value of the milk. The original method was the test glasses; many follow that system still but cream varies as much in value as milk does. Cream in very cold setting is much more bulky than warm setting, and it is not a safe or exact way to measure the value of milk. The butter fat contained in milk is the only safe test. Milk from different cows or dairies being mixed loses its identity.

Cannot calculate exactly the amount of butter from the butter fat but 100 pounds of butter fat usually makes 108 pounds of butter; can calculate close enough for practical purposes. Value of milk does not vary as much for cheese as for butter, but there is some difference.

If all the milk taken to creameries in the State could be tested it would have a wonderful influence on the quality.

#### RYEGATE INSTITUTE.

Prof. Cooke spoke on co-operative dairying. He said he was aware that a town where there were so many first-class dairymen, who got the very top prices for their products would not look with much favor upon a co-operative creamery. But the success of some creameries started among farmers similarly situated makes the subject possibly worthy of your consideration here. Your town is peculiarly adapted to the dairy business, with fine pastures and the very best of hay. The best hay we ever analyzed at the Experiment Station came from this town. Your cows largely impregnated with Jersey blood, are especially adapted for your work in producing a fine article of butter, and back of all this, old Scotland sent



in the foundation stock of this thrifty people, and if all these have a favorable bearing on the private dairy they also have the same on the creamery system. In the town of Woodstock the conditions were similar to those in this town and the results there are very favorable to all concerned. The prices you receive for your dairy butter is in advance of the quotations and there is no reason why it would not be the same if made in a creamery. The creamery system of making butter is on the increase. Ten years ago not more than ten creameries existed in the State and now more than a hundred are in operation. In a year from now, three fourths of the milk in Franklin county will be made up at creameries.

In answer to questions, Prof. Cooke said : The separator is probably the closest skimmer of any device for getting off the cream ; think the buttermilk in the State would average 1 per cent of butter fat ; the farmers cannot keep the temperature nor handle the cream as well as can be done at a well-conducted creamery ; the loss in skim milk in the State in one year would if made into butter be of value enough to build and equip creameries, to manufacture all the milk into butter. The first difficulty lies in making patrons handle their milk properly, but in your township I should judge you would handle it correctly. Cleanliness is the foundation of the dairy gospel, and some person should be appointed to look after cows and cream ; they should see that the milk is set properly and should refuse all cream not properly cared for.

Mr. Vail thought the time near at hand when butter would be made at creameries and from the milk as soon as taken from the cow. Prof. Cooke said that butter made from sweet cream was in growing demand, and the amount of butter consumed per capita is annually increasing.

Mr. Whitelaw asked if the butter made at creameries would not of necessity have to pass through the hands of a middleman. Prof. Cooke—Not necessarily, though most butter does pass through the hands of a middleman.

Mr. Vail—Our creamery is trying to place all its butter in the hands of a retailer. Mr. Whitlaw—That would be a good state of affairs, but I should think the more one man handled the more danger there would be of having to place more on the open

market. Prof. Cooke—A creamery that makes a first-class article will find no trouble in finding a good market for it, and in handling a large amount of butter it gets on the market at a lower price per pound than if in many small lots.

Mr. Ricker thought a man would look closer after his own business if alone than if associated with others; thought the tendency would be downward instead of upward. We are on a full even plane here in making butter and do not want to go down and I think each farmer would take less pains if under the co-operative plan. Mr. Vail—The most trouble has been in the division of the butter; have known the best dairymen to take their milk out on that account. Prof. Cooke—There would be no trouble in analyzing both cream and milk and paying according to value.

#### WALLINGFORD INSTITUTE.

Hon. C. H. Congdon was the president of the meeting at Wallingford. Prof. Cooke spoke on Creameries vs. Cheese Factories. In this part of Rutland county cheese factories predominate. Here and around Essex Junction more cheese is being made than in any other section of the State. Creameries are increasing in number faster than are the cheese factories, and the system of establishing a factory and having feeders is increasing 20 or 30 per year. Milk as a general thing is richer in the fall than in the spring or summer, consequently worth more for butter at that season than for cheese. Butter rises in price at this season of the year on account of the law of supply and demand. The most economical factory makes both cheese and butter. The flush of milk is in May and June, and more butter is made at that time than can be consumed. In summer butter goes begging for customers, while in winter there is much less made than is consumed. If more cheese was made in summer months it would much relieve the butter market.

Skimmilk and whey contain about the same amount of fat. Both the separator and cheese maker do poorer work in fall than in summer. The mineral matter in skimmilk is worth more than that in whey—in fact is worth twice as much. Whey has five per cent of milk sugar and skimmilk four and three-quarters, and this

element loses by the milk or wheys ousing. Whey sours more easily than skimmilk. The difference in feeding value of the two is in the curd. Whey contains one per cent and skimmilk four per cent, and the difference in feeding value of both fed sweet is six cents per 100 pounds. If fed to advantage there should be something added as shorts for calves if fed on skimmilk ; hogs the same. When whey is fed to calves linseed meal should be added, a handful to a calf four weeks old. One quart of linseed in six quarts of water will form a jelly ; one quart of that feed in whey or skim milk makes a good feed. Oatmeal or middlings added to whey takes the place of the curd taken out in the process of cheese making.

In April, May, June and July milk is worth more to make into cheese than into butter.

A. J. Newton asked : Do you feed grain to cows that come in in April for the present profit or for the good of the cow.

Prof. Cooke : Can get market value for grain if other feeds are all right and the animal will be much better off and more valuable for the remainder of the year.

John Castle : What about roots for feeding cows ?

Prof. Cooke : Sugar beets have the same amount of water as skim milk and the remainder is about the value of wheat bran. Turnips and cabbage would be more valuable if it were not for tainting milk.

## CROPS.

---

### ENOSBURGH FALLS INSTITUTE.

Wm. Chapin of Middlesex, spoke on marketing of farm crops. He considered home markets the best and wished they were larger and more numerous. Hay is our most valuable crop. We cut in 1880 over 1,000,000 tons and he thought we cut more in 1890. This crop should be marketed on the farm as much as possible: created into butter and cheese, wool, mutton and early lambs, or any other commodity. Advocates early cutting and twice if necessary; never allows any animals to put foot on his meadows to crop the fall feed. Early cut hay is best for any farm stock, but hay for market needs to stand longer. Advised making butter the year round and cultivate the best market for this product. Where milk can be sold to the consumer it brings the most money. Maple sugar is the next important crop of the State with many, and one which the atmospheric conditions have as much to do with as with the milk; best sugar he ever made was from frozen sap: thought the time would come when ice would be as important an adjunct in the manufacture of sugar as in buttermaking. I try and put my sugar up in packages to suit the customers; small cakes early in the season sell readily for 18 cents; syrup about \$1. Think in the last twenty years my sugar has averaged me ten cents a pound.

The next crop of importance is corn. This is a natural place to raise that crop. Prominent farmers in Washington County have shown by accurate accounts kept of the labor and expenses that they can raise it for 26 cents a bushel. It is no object for Vermont farmers to have the price of corn low. Beef, pork, mutton and butter are always affected by the low price of corn. This crop can always find a home market on the farm in any manner in which we may choose to harvest it. Thought a good deal of the oat crop in hill towns. Oats are a better balanced ration

than any other of our grains, valuable for horses and are a good milk producing feed.

Potatoes—We raise yearly about 4,000,000 bushels. This is a crop that needs to be gotten in as early as possible and marketed as soon as possible. Early planted and early harvested pay the best as well as avoiding the rust and rot. Never cut the seed; plant whole tubers about the size of hens eggs.

Too little attention is paid on the farm to small fruits : strawberries, currants, etc. can find a ready market near home.

A few mutton sheep can be kept in connection with the dairy and early lambs sell readily and for a good price. There is both a local and foreign demand for them. My lambs brought me the first season \$5.00 each and the wool \$1.75 per head.

Poultry is an article too often over looked by farmers ; it is of great importance : eggs always find a market at remunerative prices. As little attention as there is paid to the subject there are more pounds of poultry sent to market from Vermont than there are of wool.

#### MORRISVILLE INSTITUTE.

Mr. Clement Smith—Never made any money on poultry. I commenced farming with a mortgage on my farm and the farm has not gone yet. My experience with potatoes has been different than that of some of the speakers. My late clay potatoes did the best, rotting less after putting into the cellar. I buy fertilizers but don't let any of manure go to waste. Potatoes last year was my best crop ; raised 18 acres of corn and potatoes and did not put a hoe into them and had more weeds in the garden than in the whole 18 acres. I put on 10 spreader loads of manure to the acre and raised 500 bushels on a little more than an acre, and sold over \$300 worth. The crop did not cost me \$100. I harrow the corn twice before it comes up, then use the weeder ; prefer to plow heavy land in the fall and dry land in the spring. Every row should be straight so as to get the best results in cultivating. I plant 3½ by 2 feet ; prefer Sanford or native yellow corn for ensilage. On 45 acres of tillage land keep 50 head of cattle. The income part of the profit comes from the dairy. I sold from 29 cows \$1,930'

---

worth of butter besides what I used in my family. Cows average 250 pounds of butter per annum—15 pigs paid \$90 over their cost. Raise my own wheat ; never bought half a dozen barrels of flour in my life. In answer to questions about feeding he said : first feed hay in morning, after breakfast feed one half bushel of ensilage, on which I put one quart of linseed meal, pint cotton seed meal and one quart of bran per cow ; same at night with more hay. Do not warm the water.

## DAIRYING.

---

### CHARLOTTE INSTITUTE.

Prof. Cooke in speaking of the dairy, said : The demand for butter has changed very much in the past ten years. Now the consumers want the butter fresh made. A good dairyman should make better butter than the creamery man, but the average dairyman does not.

John Quinlan—Would not the farmer who has rich milk, get more for it if he made it at home ?

Prof. Cooke—The average dairyman would not. The home separator is doing good work. Will get more cream by its use than by any other method but it is hard work to turn it. Milk that has five per cent fat should get a pound of butter from nineteen pounds of milk.

Mr. Carpenter—Would not the skim milk made at home by hand separator be worth more than that from creamery ?

Prof. Cooke—It would be better. Calves do best on it when fed warm from the separator before the animal heat is out, but for hogs our experience is that sour skim milk is the best.

Mr. Carpenter thought it would depend on age of calves.

Prof. Hills of the Agricultural college spoke on handling milk. If you fail to be clean in any particular you will see the effect of it in the product of your milk. Cleanliness is the first consideration in dairying. There is always a slight odor in any stable ; butter with no odor is very hard to find. In the butter sent from Boston to be tested by the dairy school only one sample was found perfect. Butter in milk is what gives it its commercial value, but its feeding value does not consist in the oil ; cream has always been separated from the milk up to a few years ago in the open shallow setting. The first step in advance was the large shallow pans followed by deep setting separator and butter extractor. Milk consists

of butter fat, albumen, casein, milk sugar and ash, all soluble in water except the fat. The butter begins to rise as soon as the milk is drawn from the udder. Shallow setting favors the formation of fibrin. The centrifugal is so powerful it helps the separation of the cream. The measure of any system of separating the cream from milk is the amount of fat found in the skim milk. The separator gives the most perfect creaming. It must be run perfectly to do perfect work. I predict time not far distant when all cream will be taken by separator.

#### DANVILLE INSTITUTE.

At the agricultural meeting at Danville Mr. Luke Fisher of Cabot was called to the stand and he told his experience and methods of farming. He said we do not know how much an acre of land can be made to produce. When it was the fashion to raise roots we got from 1000 to 2000 bushels per acre. This land of course was very heavily manured. It was seeded down and it produced an enormous crop of hay and it remained so for a number of years. Have bought bone meal and applied to land with good results; takes some money to pay for it, but I think it will pay; I buy phosphate to raise corn; have grown that for a number of years. The farm now produces five times as much as it did twenty years ago. Siloh elps wonderfully to build up a farm as well as to make butter. Land that formerly cut one ton of hay will now produce twenty tons of ensilage. But ensilage is not a perfect feed; it needs other grain to balance. I begin my haying June 15; clover is a very important crop. My practice is to have most of my cows come in in the fall of the year. I send my butter to market every week. My winter feed is first in the morning a feed of this dried grass; after this is eaten the cows are turned out and watered, the water being warmed to 95°. The cows go back to the stable as soon as watered and are fed three pecks of ensilage with four to five pounds of mixed grain, consisting of cotton seed, corn, oats, linseed, bran, etc.; more kinds the better. After eating this feed the cows all lie down, and I prefer not to have any person go near them till 4 o'clock, when we feed ensilage and hay with the same amount of grain as in the morning.



I am at present milking 17 cows and make from 165 to 175 pounds of butter per week ; use deep cold setting. I think it will pay me to put in some kind of separator. They churned at the Station last week cream at 35°, and in nine minutes it was curdled and in fifteen it was butter. I have been churning sweet cream at too high a temperature and am satisfied I have been losing money by it. I am attending the dairy school at Burlington and trying to learn how to make butter ; thought I knew something before, but found out I did not. It is a splendid institution and every farmer in the State ought to take advantage of it. I believe in feed and breed, blood will tell. My cows are Jerseys. I advocate feeding twice a day instead of three times ; cows lose over a quart of milk each if water is not warmed. It is better to let a cow have a month or two rest than to try to milk the year round. It is some trouble to dry them off at ten months but I shut them up and feed on oat straw with a little water. Cows will gain in flesh very fast after being dried off. I have several that would stand more grain than what they get.

Mr. Sanford asked—Do you consider it necessary to give a cow rest every year ?

Mr. Fisher—Yes ; a cow ought to have two months' rest every year. Last year I milked some that were not rested and they disappointed me, but last fall they were rested and this year are doing better.

Mr. Vail—Don't you think cows have off years ?

Mr. Fisher—Yes, and they are sure to come if cows are not rested. I have cows that will give 40 pounds of milk a day,

Prof. Cooke—What do you think would be the largest yield of butter per week for your best cow ?

Mr. Fisher—I do not know, but I have no doubt but what we have cows that will make over 500 pounds of butter in a year. Last year 22 cows and heifers made 8,271 pounds of butter or 371 pounds per cow. I think we can make farming pay in Vermont. I have only 50 acres of meadow and only 29 of that is mowing ; 21 in crops ; keep from 40 to 50 head of cattle and horses. I plant Sanford corn for ensilage ; I plant with single planter. We raise 22 tons per acre ; plant in drills, space four inches apart in

rows  $3\frac{1}{2}$  feet apart. We apply the manure in the fall on land ploughed in the fall and get corn one foot higher by manuring in fall than spring ; put on 500 pounds of phosphate to the acre.

Mr. Smith—Which do you consider the most valuable a ton of hay cut on poor land that will cut less than a ton per acre or a ton raised on land that will cut three tons per acre at two mowings ?

Mr. Fisher—Hay grown on land rich in plant food is the most valuable. I have had satisfactory results in ploughing worn out pastures applying 1800 pounds of phosphate per acre, sowing grass seed and oats. It grows a large amount of feed and cattle will not leave it for any other place to feed.

Mr. Smith—What kind of grass seed do you sow ?

Mr. Fisher—Timothy, red clover, Alsike, red top and as many other kinds as I can find, the more the better.

#### FAIRHAVEN INSTITUTE.

Mr. James F. Converse was the first speaker. He is a prominent agriculturist from Woodville, N. Y. He alluded to the dairy interests of the State as our leading industry and said the United States were milking 15,000,000 cows and judging from the statistical reports one-third of the number were being milked for the pleasure of it. The shortness of the products of a single cow amounts to but little, but in the aggregate it is immense. Thought one good judicious cross would increase the value of the cows in the United States many thousand dollars. Never should breed to a bull whose ancestry could not be traced back many generations. Estimated one-third of the cows were not self-supporting. If we had commenced to improve where our fathers left off we might be much better off. The cry of some of our farmers that it is all in feed and none in breed is erroneous. We want cows whose ancestry were great performers. If we could trace a sire through a century of good performers we should gain much. The sire transmits one-half of his characteristics to his progeny. Spoke of one cow which had given 30,000 pounds of milk in a year. This great yield was obtained by selecting a cow whose ancestry was desirable. The best cow in the country can be made a scrub by ill treatment. Feed and care are always important, and the finish is put on with

these. We find some intelligent farmers who insist in cross-breeding and make failures of it. This is all wrong ; should always breed in the same line. Take one of the many good milking breeds and stick to it breeding from thoroughbred sires.

In answer to questions, Mr. Converse said—Most of our farmers draw the manure in winter and spread where they are to plough or harrow next spring ; some draw from the stables every day, saving the liquid and solid ; no waste when applied in that way.

Mr. Smith of the Board—Twelve years ago when the members of the State Board advocated such a practice they were characterized by some agricultural journals as cranks. Now every farm journal is advocating that idea but not one-fourth of the farmers in Vermont are heeding it.

Mr. Smith answered questions as follows :

If sward land has had the manure spread on through winter, it will do to plough much deeper than if just applied, the action of the thawing snow and rains have washed the fertilizing elements into the soil and they have become incorporated with it and I consider this the most economical way of applying the fertilizer to the soil. I plough my corn seven inches deep when thus fertilized. On sand or clayey loam can care for the crop with much less expense than when ploughed in the fall and manure applied afterward ; weeds are the natural results of manure applied on top of furrows.

Mr. Chapin—That kind of culture would not work successfully in any hill country ; we want the manure on top to get the greatest amount of warmth as soon as corn is planted. Plough in fall and spread on furrows and harrow in.

Mr. Converse of Woodville, N. Y.—Think four inches deep enough for corn ; if ploughed too deep the corn roots, which are shallow feeders, will not reach the elements desired. Have no doubt of the benefit to the land by ploughing deep but think the first crop will not reach or recover the benefits of the manure.

#### HYDE PARK INSTITUTE.

Mr. Clement Smith of Morristown, one of the most successful dairymen in Lamoille county, gave his experience in dairying. He

is at present using a baby separator, a No. 2, which will separate 300 pounds per hour. This is run by a yearling heifer (Jersey) in a one-horse tread power. Mr. Smith says the working of the machine is complete and the heifer enjoys the work. All he has to do is to unhitch her and she goes into the power of her own accord. By having this machine in the barn he can feed the skim milk warm from the cow to his calves and hogs, and considers it more valuable when fed in natural warmth than when warmed artificially. He has tested the separator with the deep setting several times by taking seven milkings with each system and alternating, and finds the present way will make about two pounds a day the most. It is not so much work to keep the separator clean as the cans in deep setting. He sends his butter to market in prints, and it averages about 26½ cents per pound the year round.

He waters his cows in the barn and does not warm the water; churns twice a week, cooling the cream to 48° till ready to ripen, then raise to 70° and cool down, churning at 64°. Thinks the cream from separator is more easily churned than from deep setting; 18 pounds of his milk will make a pound of butter. He has sold from his dairy \$69 per cow of butter alone and fed them \$10.65 worth of grain each. Skim milk is worth nearly as much as the grain fed the cows. The separator takes the lead of all others.

#### GREENSBORO INSTITUTE.

Mr. Rawson said: We had no stock on our meadows for 20 years, but for the last three years have fed them. We carry 20 head more stock than five years ago, and I get more than \$100 worth of butter from my fall feed. In answer to a question, Mr. Rawson said: We plow fifteen acres in the fall for hoed crops, following them with sowed crops and seed to grass. We are troubled to get a good crop of sowed grain.

Prof. Cooke, in answer to question by Mr. Bronson, said that any of the acid tests of milk are correct. A machine will cost about \$10 and each test will cost about one-quarter of a cent. There are fifteen kinds of separators on the market and six hand machines. A good separator must be made of the best kind of material.

Mr. Sanford said it was of the utmost importance that farmers should test their cows and know what they have got. Mr. Sanford also spoke of the good work now being done by the Experiment Station and Dairy School and thought every farmer in the State should avail himself of these benefits.

Mr. King in answer to questions said: I make 300 pounds of butter per cow; feed cotton seed meal, corn meal, oats, gluten, bran, etc. I feed from one to eight quarts per day, according to the cows. My coarse feed is hay; can not cut my hay as early as I would like to; can not cure it; feed oats to cows on straw.

#### TROY INSTITUTE.

Prof. Cooke in speaking of milk said that: whole milk contains milk sugar, casein and fat. Rich and poor milk contain about the same amount of milk sugar and there is more of this ingredient in ordinary milk than of any other. Casein varies from  $3\frac{1}{2}$  to  $4\frac{1}{2}$  per cent and these variations affect the cheese value of milk, but not the butter value. If there was no casein in milk there would be no effect produced by adding the rennet. Casein in coagulation catches and holds the fat. If stirred too soon after rennet is added you will lose much fat since the casein will not hold it all. June milk, which contains  $3\frac{1}{2}$  per cent casein will hold the same amount of fat. Such milk is properly proportioned for cheese making and will make a cheese such as the market demands.

Milk increases in casein as the seas on advances, but the casein does not increase so far as fat. Milk, late in the fall and in winter, is worth more for making butter than for cheese. Factories should make cheese in summer and butter in winter. The variation in fat is more than any other ingredient. Two and eight tenths fat is the poorest milk we have ever examined. Some herds in the State give one pound of butter for sixteen pounds of milk—one cow at the station makes a pound of butter from 11 pounds of milk, and instances are known where they do even better than that. Some breeds average to give richer milk than others, for example the Jerseys and Guernseys.

The Ayrshires, Holsteins and Durhams are recognized as milk breeds and have less fat in the milk. The Devons and Red Polled

stand between the two other extremes. This applies to families of cattle and not to individual animals. Individual animals differ far more widely than breeds. Holsteins differ more than other breeds. There are three elements that act on the quality of the milk; those are "selection, feed and care." Some breeders of Holsteins have brought up their herds almost equal to any Jersey. In some tests of the heavy milking breeds it takes from 25 to 30 pounds of milk to make a pound of butter; in other herds it takes from 14 to 16.

There has been much misunderstanding in regard to influence of feed on milk. Feeding cows on green barley, good hay with eight quarts of bran per day is sufficient feed for a cow and a well balanced ration. Now change this feed to corn, cotton seed meal, oats, gluten, etc., and the chances are nine out of ten you will not change the value of the milk a particle. Cows fed on straw changed to good fodder will give more milk, but no one can tell whether it will be richer or not. Change from one good fodder to another will not change the quality of the milk. Palm nut meal is the only feed known that will have a direct influence on the quality of the milk. Generally speaking the small cows give the richer milk and the larger the greater flow.

Mr. Stevens of Troy thought one of the most important problems for farmers to discuss was the marketing of farm produce. It lacks system. I will not undertake to instruct people in regard to it, but it is all wrong. Mr. Chapin said selling was as important as raising. We need to get as near the consumer as possible and put our produce in as attractive form as possible. Maple sugar and dairy produce especially should be made to look attractive, and our most successful farmers in these specialties make them attractive.

Mr. Stevens said there were good dairymen in the county who send to commission houses, and the consumer of this pays twice as much as the farmers get. We should get nearer the consumer. There are men in this room who have sent their butter to commission houses and lost the whole of it.

Mr. Chapin said he made butter the year round, and the average price was about 20 cents.

Mr. Stevens asked if the products of a winter cow were more than a summer one. Several farmers said that a winter cow would produce the most.

Mr. Charles Manuel had used a silo six years and he would have one if he had but one cow. He put in fodder cut short and raised white Southern corn.

Mr. Wakeman raised Sanford corn for silo. He always got it large enough to boil and this year saved seed.

Mr. True put ensilage in the silo after the corn had been frozen. He did not see but that it was just as good as any, but was not ready to advocate freezing it before cutting. About shipping butter Mr. True said he put it up in good style. Make a nice article and don't be afraid to send to a responsible dealer. Good first class butter will always sell.

Mr. Currier said there had been a complete change in the butter market in the last twenty-five years. We used to send butter west, but now the west is our strong competitor. Freight from Elgin is about half as much to Boston as from Vermont, and other business the same. The south once had nearly all their implements made at the north. Now the Yankees have gone there and are making these implements. The trouble with Vermont to-day is this: We had a war and money came fast, but we did not raise our mortgages. We should run this State government as cheap as any State can be run. We have been buying too much corn. We keep too many dogs. Some of our men don't know that one load of manure applied to the field is worth more than ten left in the yard. Our roads should be improved. We are not working them judiciously, and better roads would bring more money to farmers. We should look to our road building as well as to our crops.

#### WILLINGFORD INSTITUTE.

Mr. Smith answered questions in regard to winter dairying as follows: September and October are the most profitable months for a cow to drop her calf; should not be turned into fresh feed till calf is a week old; never let the frost strike the back of a new milch cow; stable every night; raise more grain and raise and harvest for as little money as possible.

The silo is the cheapest way to harvest corn ; would plant for a silo just as I would for a harvested crop. Labor is the problem for Vermont farmers to solve. Should strive to use it to the best advantage. It costs too much to husk, shell and grind corn ; can get just as much feeding value from the silo as if put in crib, and the stalks are worth much more in silo than any other method of harvesting. A cow will produce about one-fourth more milk during the milking season if she comes in in October than she will calving in March.

Do not begin to put corn in silo till it is large enough to boil for table use. Only about 15 per cent of the butter made in the United States is made in the winter. The Americans as a race are not great consumers of cheese ; the English are and Canada is our strongest competitor in the English markets.

#### WESTMINSTER INSTITUTE.

John Gould spoke on the "Man that Owns the Cow." He said : when the dairymen pool their issues they will come out ahead of the bankers. The dairyman is a very industrious citizen. One third of the cows and one third of the men produce more than the other two thirds. Dairymen of Minnesota are now competing for the New England market, it costing them only one and one-half cents a pound to set their butter down in Boston. The greatest competition a dairyman has is his own ignorance. We need a better cow, better understood and a smaller expense. When this problem is solved Vermont has the advantage and that is what we are striving for. The cow is now merely a machine, taking in so much food and turning out a flow of milk proportionately rich. Just so far as we understand that machine and get in harmony with it, so far do we succeed. The cow always understands her owner better than he does the cow. The great difficulty is we forget her functions as a mother. The man who does not understand and treat the cow as a mother, loses. He can't go blindly to work and succeed. He must understand. Luck is only applied science along these lines. Her only vocation is to give continually. Each day she gives back to her owner what she gets from him. Artificial feeding, artificial development and artificial giving characterizes



the cow now. Some insist that a cow must be a beefer and milker, a general purpose cow, but such a combination is impossible. Here dity controls the supply. Like always produces like and the dairyman must look for the right cow. Feed does less than heredity. Remember that like produces like and keep to that line. Form is everything and we see it exemplified in Sheridan's horse which was from a family that had been bred as runners for 2000 years. He got there while the clumsy Percheron would have lagged far behind. The farmer's wife is the best dairyman and best understands the care of the cow.

#### WILMINGTON INSTITUTE.

After Mr. Smith's address on winter feed for stock Henry Adams asked : How much ensilage do you feed per day to your cows ? Mr. Smith : With native cows about 20 pounds is enough.

Mr. Haynes : How much does it cost a ton to put your silage into the silo ? Smith : Not over 50 cents a ton.

Mr. Adams : How about weighting the silo ? Smith : Do not weight, put on some hay and straw and keep treading down.

Mr. Copeland : I find some corn is not utilized by the cow and keep hogs in the manure cellar.

E. A. Fitch : When do you cut your oats for hay ? Smith : About the time they head out. I do not ensilage oats.

Mr. Mann : Do you have bad effects feeding whole ensilage ? Smith : None whatever.

E. Z. Copeland : I have had some experience in ensilaging oats and barley and do not like them, better be put into hay. Have also used clover but think it better to hay it and put it in the barn.

Mr. Sanford : How do you account for the manurial value of green grass ? Mr. Smith : It begins to decay very quickly and warms up the soil ; it also makes the soil light and admits the air. I use no commercial fertilizer.

Mr. Copeland : Have you ever tried the 90-day dent corn ? Yes, with favorable results.

Mr. Copeland : Do you feed cotton seed meal ? Mr. Smith : Yes, with good results.

---

Mr. Adams : Would like to call the attention of the farmers to the practice of feeding meadows ; think the practice is hurtful to the land ; better mow and feed the rowen. Mr. Chapin and Mr. Sanford agreed with Mr. Adams. Mr. Copeland : Think we get the best results in seeding the corn field when level culture is practiced.

Mr. Smith in answer to further questions said I water only once a day, do not warm the water ; salt twice a week. Think cows will do just as well watering once a day as twice.

## FEEDING FARM STOCK.

---

### CALAIS INSTITUTE.

J. O. Sanford—Winter feed for any kind of stock should approximate as nearly as possible to summer feed. Feed young stock to produce growth and not fat. It is a very nice point to feed a heifer and keep her developing in the right direction. Any fodder that will produce growth will produce milk. After an animal has got its growth feed for its development; think small cows are kept with more profit than large ones; from 800 to 1000 pounds is the best size.

### GREENSBORO INSTITUTE.

At the afternoon session, Mr. Smith spoke on feeding farm stock in which he strongly advocated the necessity of farmers raising feed and buying less. He thought the quality of our coarse fodder was of the utmost importance to stock feeders of any kind. Hay should be cut early—many farmers commence early enough but do not put on help enough and are too long in doing the work. Hay should be all in the barn before the seed forms. He also advocated cutting oats green for hay where the crop is to be used for cow feed; it saves the expense of threshing and the animals get all the nutriment. Corn can be put in silo cheaper than to harvest any other way and there is less waste in feeding good ensilage than in any other way. He puts corn in the silo whole; no spoiled ensilage except in corners; would make the corners rounding much as possible.

Chairman Cooke said he had 20 years' experience in raising and feeding oat hay and he considered it the most profitable way of harvesting the crop for cows. He wants it cut early, as soon as the heads form; thinks barley cut for hay the best feed he ever fed. It needs to be cut as soon as the heads appear.

Mr. Smith said in answer to questions by Mr. Bronson—I seed with timothy and clover. I like alsike very much for hay, but am

unfortunate with it; does not remain long on my land; think stock hay is better where many kinds of seeds are sown. Red top is an excellent hay for any kind of stock and farmers should use more of it.

Mr. Bronson said he had sown clover on stubble land with good results. Spots on fields that had winter killed if sown early would produce a crop. Mr. Smith said this could be done if the land was in a high state of cultivation.

Mr. Sanford of the Board said: In regard to silos, people are apt to build them too large and not deep enough. Six square feet of surface per cow per day is about the right proportion to keep the ensilage sweet. If the silo is cut down it will injure as it comes to the air; should feed the whole of the top off every day.

Mr. Bronson had fixed the corner of his silo with six inch boards, filling in behind the boards to make it solid, and he found it improved the keeping quality of the ensilage.

Mr. Smith, in answer to a question, said: Where only one pair of hands does all the work on a small farm it might be very inconvenient in filling the silo, but with some neighbors in like situation, a change could be made and perhaps benefit both. He would have a silo if he had only one cow.

#### HYDE PARK.

Mr. Smith of the Board said the furnishing feed for farm animals had always been an interesting subject for farmers to discuss and was getting to be more so. Pastures that once played so important a part in our husbandry were of much less value than formerly and growing poorer every year, and farmers especially dairymen, were feeding many more days in the year than formerly. Full barns are not always a guarantee of fat stock or full pails of milk. Feed that produces milk will make growth if fed to young stock. Hay cut in August, though of more bulk, is not so valuable as early cut fodder. Keeping a winter dairy teaches the farmer very much in regard to the worth of different fodder crops. A change in the coarse feeds affects the milk sooner than a change in grain feed. With the present high prices

of grain it cannot be fed profitably unless the course fodders are good.

#### WILLISTON INSTITUTE.

Mr. Vail spoke on the economy of feeding farm stock. We need stock that is worthy of our care and labor which represents money, and in our practice of feeding we should attempt to follow out nature as closely as possible. Warmth is the natural condition of the animal and green grass the natural feed. Our dairy animals, therefore, need a warm place and succulent food. The silo is the sheet anchor of success in winter dairying. Ensilage takes the place of roots. By weighing the milk at every milking and changing the feeds you can learn what effect they will have upon milk.

Mr. Whitney said the Board could do no better service in the community than to tell them how and what kinds of grain to feed.

Prof. Cooke—I like to feed equal quantities in weight of each kind of feed. A good feed for an average cow is made of one pound cotton seed meal, one pound of corn meal, one-half pound linseed meal, one-half pound of gluten meal, and equal parts of bran middlings and oat meal.

#### WESTMINSTER INSTITUTE.

Rollin C. Smith of Pittsford was the speaker and Feeding Dairy Stock was the subject. He said: The question of dairying is like the question of the housekeeper—feed. Our pastures and fields are not what they were in our fathers' times, producing immense quantities of rich, sweet grass. The conditions have changed and the pastures that produce white clover now are very rare. The grass itself is not what it was. The grass is now wiry and unnatural and the cow keeps up her flush of milk only on fresh grass. The average production of hay to the acre in Vermont is only one ton. It is true that some farms produce two tons, and a smaller number as high as three, but that brings down the rest of the State to a production of only half a ton of hay to the acre. One cause is that farmers are mowing too much land and there is not fertility enough to support a heavier growth. It is expensive in two ways.

It is not so valuable and takes nearly as much time to cut. Another mistake is in not cutting it in season or curing it properly. Hay must be of the best. Grain cannot keep the cows up to their best without it. First-class winter dairymen have learned that on the hay depends their success or failure. If any man doubts this let him change his feed from good to poor hay. The shrinkage in milk is visible at once. But the average farmer does not learn this soon enough. Farmers begin haying early enough, but do not finish when they ought. Many hay in August and cut herds grass which has less life and nutrition than a stick, and is almost worthless for dairy or growing stock. Again a farmer cannot feed with any profit when pastures are only able to sustain life. There was a time when our pastures would keep cows in milk and send them up to the barn in the fall sleek and fat but that time is gone.

Too many farmers cut hay now which is worthless, but if cut as it should be the possibilities of the State are such that more than double the present amount of stock could be kept in winter. Hay must be cut before the seeds are formed and dried without wetting. Cut early and cure without getting the dew on it. One farmer said he couldn't see any difference in the hay, but the cow will see it and the farmer will notice it in the milkpail. The laboratories in the stable tell as well as science. The cattle know what they want and will not take what they don't want if they can get what they do want. I know one man who keeps three or four cows, and cuts his hay two or three times a year, and makes 633 pounds of butter to the cow. Know the value as feed of the grass put into the barn for hay.

The amount of grain bought is too large. The average Vermont dairyman should not buy grain. Vermont can raise corn now as well as fifty years ago. We know more of the life and growth of the plant and have better facilities than our fathers had, yet they did it and we can. As soon as the hay is off my land, I stake out my cornfield for the next year. I put the fertilizer on the grass stubble and keep putting it on until winter. I want the water from the rains and melting snows to wash that fertility down among the particles of soil. The soil takes fertility best when the

frost is coming out in the spring. Let the field remain as late as possible before plowing. Too much corn is planted too early rather than too late. Let it germinate as soon as possible and keep it growing. Plow with jointer, and not coulter, turning grass under; It is the best fertilizer to be found. Use a wheel harrow and pulverize the land as fine as possible. Work up smooth and plant. Plant with a planter; a horse planter is the best; a hand planter is apt to get it too deep. After that harrow the field as long as you dare to, then cultivate. In cultivating keep the field level; do not hill. Cultivate three or four times, and just before the corn tassels, seed the field between the rows.

If you are to feed it to cows, put it in the silo. Cows like it better and you save the husking, shelling and grinding. If you carry to mill you lose the toll and have your feed in a very condensed form. With the oat crop it is better to cut for hay when the heads are just out. An excellent feed is two bushels of oats and one bushel of peas to the acre and mow just as heading and feed for hay. I feed what hay the cows will eat in an hour; about 10 o'clock turn out, clean stables, water and feed and put back and feed with ensilage. After that I feed with oat hay and let them go until morning, finding that they do better on two feeds a day. The result is I am getting as much as when I feed grain. If farmers would study the value of fodder their purses would be heavier than now. I do not say, feed no grain, but I say in this combination you have the basis of food required in successful dairying. I use Longfellow corn. It is a sturdy grower, but late. My cows hold up and gain all the time. Sow one bushel of peas to the acre with your oats and cut when beginning to pod. It helps the land by clearing it of foul stock before it seeds. Anything with hollow stalk like oats would ensilage difficultly.

## FERTILIZATION.

---

### CHARLOTTE INSTITUTE.

J. O. Sanford was the first speaker, and his subject was "Clover and fertility." He believed clover to be one of the most important crops we can raise. We once used it mixed with other seed, now many sow it as a crop and make a specialty of it. After a crop has been removed the land is better than before. With two cuttings we get about three tons, and it is a perfect ration for a milch cow and is equal in fertilizer elements to about \$15 of commercial fertilizer. Clover should be cocked up and covered with hay caps and care should be taken to cure so the leaves will remain on the stalk. Do not dry too much. Some use it as ensilage. It can be put in without cutting and costs but little.

The fertility of our farms has wasted away in a great measure and farm help is very dear, consequently we must concentrate our work, have less acres and more fertility. We can do it with commercial fertilizers but the cost is enormous and the money goes out of the State and it is not profitable. We want first to stop the waste of what fertilizer we make on the farm. Our buildings should be so constructed as to save the whole; feed out our crops to some paying stock. Our crops do not all belong to our pocket books—farms have a claim on what grows on them and the farm should be considered as a factory and we as the agents. When we adopt more intensive farming we shall stop the wastes of the farm manure. Our lower lands should be all underdrained and road fences removed. Manure may be drawn at any season of the year. If you are running a dairy exclusively, then raise just what you wish to feed to your cows and let other crops alone.

Mr. Henry Carpenter—If clover does not exhaust the soil of the mineral elements, where do they come from?

Mr. Sanford—Clover is a strong feeding plant of potash and uses that which may not be available to other plants. Plaster is not a fertilizer of itself, but acts as a reducer of plant food so it may be available.



Mr. Quinlan asked if small farms could be conducted cheaper than large ones.

Mr. Sanford—Think where you can contract your farming it is better.

Mr. Carpenter—When cows are stabled in summer, is it not done at expense of our pastures?

Mr. Sanford—The question of the pasture is settled; they are going back and we can enrich our meadows.

Prof. Cooke—Clover has two excellent qualities; first, taking the nitrogen from the air and draining the potash from the subsoil where other plants do not reach. Clover takes its food from below where you plough. The tendency of plant food is downward. The oat plant is a most delicate feeder and clover fits the land for it.

#### CHELSEA INSTITUTE.

Mr. Smith was the next speaker and his subject was: "Can farmers afford to use commercial fertilizers?" He took the ground that a farm should be made to produce all it is capable of producing. It should carry a certain amount of stock every year, and all the farm manure should be saved and applied in the most economical manner. A farmer should calculate to raise a certain number of acres of grain, use all the farm made manure and supplement with commercial when necessary. He thinks that potatoes can be grown with phosphate with better results than with stable manure, but would never advise using any commercial fertilizer at the expense of the yard manure. Did we know just what our fields needed we could use some special mixture. For example, some fields are rich in potash—when this is the case it would be foolish to purchase phosphate containing potash. Others have ammonia enough, etc. I would advise plot experiment and know what was needed; otherwise you will have to purchase a complete fertilizer.

The "Fertilizing value of foods" was discussed by Mr. Vail of Pomfret. The different kinds of feeds vary in food and fertilizing value and bear no relation to each other. For example, corn meal is worth, as a fertilizer, from \$6 to \$7, after being fed to animals, rating its ingredients the same as they cost in the market. Cotton seed meal over \$20, gluten about the same, bran \$13, linseed meal

very high. If they can be fed so as to get back the first cost, it is a cheap and sure way to add fertility to the farm.

In answer to questions Mr. Vail said all plants take their food in a liquid form. Plaster is an excellent deodorizer and it should be used in stables. It holds the ammonia. Should spread manure in fall for any crop. There is very little loss by evaporation. There is a great deal of India wheat raised in this section of the country and dairymen pronounce it a profitable crop and an excellent feed.

Mr. Dearborn said he kept a dairy and supplied the village with milk. His feed was one-third barley, one-third India wheat and one-third oats or cob and corn ground together and fed ten quarts per day to each cow.

Mr. Hayward—More than a third of the grain grown in this town is "India" wheat.

Mr. Carlton—I have raised over 500 bushels this year; sow one bushel per acre; wet the seed before sowing and roll in 100 pounds of phosphate and it will produce over 20 bushels per acre on very poor land. I have a poor piece of pasture where I raised India wheat for six successive years, and now witch grass has come in and it makes first rate pasture. I think the best way to improve worn out pastures is to raise India wheat a few years.

Major Richard Smith There is no need of buying cotton seed meal for coloring butter when India wheat is fed to cows. A farmer present said the hulls should be removed when ground. Mr. Carlton said the hulls should not be removed. It was a very heavy feed and needed the hulls to lighten it a little.

Mr. Sanford said a neighbor of his fed a peck of these hulls a day per cow with good results.

Mr. Vail—There is a large amount of protein in them, and he had fed them for a muscle-forming food.

Mr. Dearborn said that he fed with oats; they were an excellent feed for horses or any other stock.

Mr. Bixby—Everyone who raises turkeys or sheep should raise the wheat on their poor soil; get good crops every year, from 20 to 40 bushels per acre.

Mr. Dearborn—It won't bear very rich soil.

## SPRINGFIELD INSTITUTE.

Hon. C. Horace Hibbard said the saving and applying of manures was the secret of success of Vermont farmers; told of instances where farms had doubled in production in ten years. Spoke of the improvements in ploughing and harrowing in twenty years; spoke of the increased value of the manure where cotton seed meal was fed; had seen fields where it was spread by side of other manure, and its superior effects could be plainly seen. Thought the application of plaster is something farmers should look into; is good for clover; have applied to corn, and made two feet higher growth than when left off. Thought land should grow some crops; gave an instance where a small piece of land heavily manured was left one year without any crop, and for years after it produced less than the rest that had been cropped and had the same amount of fertilizer applied.

Mr. John Hall : What about spreading manure on the surface?

Mr. Sanford : I prefer that way. I plough and spread from the barn cellar and harrow in the next spring. Believe farmers should not cultivate more than what they can make rich and get two crops each year.

Mr. Colburn : Would you spread on ice or where it washes badly? Mr. Sanford : I don't think the manure looses much where the wash will not carry away the soil.

Mr. Colburn : Don't you think sheep manure more valuable than that from cattle? Mr. Sanford : Sheep manure as saved in sheds with liberal litter is much better than that from cows as thrown out of doors; for the liquid portions are all saved, but when the liquid is all saved cow manure is as valuable as sheep.

Mr. Colburn : The use of fertilizers is the corner stone for the Vermont farmer; have used plaster with good results; think we should contract our farms; rough meadows that can not be mown by machines had better grow up to brush-woods and are preferable to bare hills; think the government has been too liberal with the Western farmer; grain production increased 119 per cent from 1870 to 1880, and the effects are felt all over the world; the New England farmer will have a better time if he takes heed of the experience

of the past; the past depression in agriculture should prove a blessing to him.

WALLINGFORD INSTITUTE.

Mr. Sanford of the board read a paper on the use and abuse of manure made on the farm and emphasized the importance of spreading on the field as fast as drawn from the barn.

Mr. Child said: I have practiced that method for years and am sometimes inclined to think I waste some of it.

Mr. Sanford—Think less is wasted that way than any other; farmers cannot afford to pay for handling over twice.

Mr. Sanford said in answer to a question about pastures: I believe our pastures that are worn out and brakes, hard hack and other weeds have got a foothold in are worth more to grow up to wood than they are to redeem.

Mr. Childs thinks the proper method is not to let the brakes and brush get there.

Mr. Staples of Danby—My father's method of farming was to add field to field till he had 553 acres and had taken \$21,000 in hard cash from it. He left me the farm with a large mortgage on it to pay the other heirs which I never could have done had I not had other sources than the productiveness and proceeds of the farm. That \$21,000 represented the plant food of the soil all taken by my father. I had the soil, but the productiveness was gone. I leave it to my sons with this advice: Let the back lands grow up to woods. Contract your labors to your best land near home and practice a more intense farming, we can not return fertility to worn out mountains without a great outlay. Land grown to steeple tops, hazel brush and brakes will not pay to reclaim. Farmers should divide their farms up when they leave them to their children. Less land and better farmers is what we want at this time.

Mr. Sanford—I believe the coming method of farming will be to contract the number of acres. I have used liquid manure by hauling to the field in barrels and spreading also by the use of absorbents and prefer the latter method.

Mr. Nobles—Muck is not worth much as a fertilizer.—Mr.

Congdon. Think muck more valuable for an absorbent than sawdust is.

Mr. Sanford—There is a great difference in the value of muck. Think the farmers should take advantage of the Experiment Station and have the muck in their swamps analyzed and know more in regard to its value.

Mr. Smith, Danby—Apply manure on top after plowing with good results. Mr. Sanford—The fertilizing elements in manure are not available till soluble in water. Manure in large heaps goes through chemical changes and there is less loss when spread as soon as made.

Mr. Goss—Think my farm gets the benefit of the manure my neighbors spread on their lands above mine. If I spread broadcast in winter think the river will get more than the land.

In reply to questions Mr. Goss said : I raised good corn on ground ploughed just before planting with manure ploughed under, 300 pounds of phosphate to acre. Harrowed once in four days ; hill with a two horse hoe. Mr. Smith of the Board—Think Mr. Goss all right, except the hilling ; believe he would have gotten better results if kept level.

Mr. Staples told of the Swedish settlement in Mt. Tabor. Not more than an acre of land under cultivation, with eight families ; children without schools and men all at work on the lumber jobs for wages. These families settled here at the State's expense. First, land not fit to settle on and second place. men not at work on land.

#### WESTMINSTER INSTITUTE.

J. O. Sanford of Sanford, took for his subject, "Intensive Farming," and handled it ably and in a convincing way. He began by talking to the boys, telling them how he went to work to clear his farm of snakes, and told them that their characters were farms, and that they must be careful to rid them of snakes and lizards, which always infest them if the hedges and rocks of vice are not kept cleared away. Then he went on to say that intensive farming is our only salvation. Three years ago people would speak of the general depression of agriculture, and say if there is anything you can tell us to do to help us please do so.

We have been through a terrible siege, but the bottom is reached and we are on the upward turn. This depression was all right and was a necessary school. We hear no complaint this year. The difficulty is that it has been the practice of farmers in the past to get all they could from the soil, "skin" it, as it is termed. Then it has been hoarded as a miser hoards his gold, and he has had no respect for mother earth. The consequence is, the fertility is gone. It is only a few years since men began to learn that fertility had a limit. Some changed their system and are making a grand success of their business. These same men are now farming with the idea that fertility is their stock in trade. We can do only as the merchant does. We can save a margin from our land, but the rest must go back. See the difference in profits from an acre of land. One acre will produce three tons of hay and it will cost three dollars to harvest, but it is worth \$30. There are five dollars worth of fertility in each ton. This gives us \$15 as the fertilizing value of manure from the product of an acre, and the cost of cutting, three dollars, leaving \$12 as the profit of one acre under this form. The profits from one ton, the average product is only four dollars. The last is interest on \$66, the former on \$200, but an acre which produces the interest of \$200 is injured less than the one which produces the interest on \$66. I confine my operations to a few acres. Years ago men began to leave their farms on the hillsides and went into the valleys. Farmers in the valleys bought these farms and ran them in connection with their own, but I cannot afford to leave my home farm unless I hire help to carry it on. And right here let me say that this help question is enough to drive one distracted. But I am almost independent of help, and all of us can become so more and more, by the judicious use of machinery, and we can get much more profit from it. If a man is bred this way he masters his business and will be a good business man. If the younger men, on whom we must depend, can see business methods used in farming they will stay on the farm. They will never do it until farming is made delightful and profitable to a boy and he has made it a business.

There is nothing like the poultry business to pay a profit, but it must be seen to. Two hours a day will suffice, and a boy might

be in a store loafing those two hours. Still one must know the poultry business and comprehend it. See the business of farming, how it has lived. Farming has lived in spite of waste in all departments. I want to lay down this rule, the great law of success in farming. Seek ye first fertility and all these things shall be added unto you. The fertility of farms is now gone and must be restored and maintained. In planting corn by the old method one picks out his worst run down field and plants it with corn. A better way is to bring it up to the highest state of fertility before. It can be made to produce three tons of hay to the acre as well as less. Under the old method if a man had 24 cows consuming 60 tons of hay it required 50 to 80 acres of meadow land to produce it. That is not profitable to-day. Sixteen acres of meadow are all he wants to produce the same amount. Of this he wants ten in grass yielding three tons an acre, six in corn yielding 18 tons an acre, enough for 24 cows. The ration should be 12 pounds of hay, 30 pounds corn, three pounds cotton seed and three pounds of bran. These 24 cows will average 20 pounds of butter for 210 days, equally 4,200 pounds at 25 cents or \$660 in cash for the seed from 16 acres after deducting \$390 for feed purchased. I would recommend winter dairying and build barns so as to save all the fertilizing materials particularly the liquid portion. Vermont farms do pay, they pay the farmer, pay the hired man and pay the terrible waste of fertilizing material—a waste greater than any other business could endure. To bring a field up to fertility it is not necessary to buy fertilizers, but sow oats or other strong feeding plants and plow under. Fertility is the farmers' stock and must be maintained or he has no capital. In fertility the east is far ahead of the west as statistics prove. Western competition has not brought us to the present condition; it is the farmers' own fault and they are beginning to understand it so. There are many things like butter and eggs which we can produce better than the west and we should concentrate our efforts on them.

## FORESTRY.

---

### GREENSBORO INSTITUTE.

A lively discussion took place on the subject of renovating worn-out pastures, and quite a number favored letting the brush grow on the poorer places.

Mr. Tallman said he had a piece of woods cut over 25 years ago that is now a heavy growth. He began to thin it out 15 years ago and has got wood enough since to pay expenses. On five or six acres of this woods there are more than a thousand maple trees more than a foot through.

Mr. Chapin of the Board said we were apt to despise these little scrub spruce when they grow up in our pastures, but where they are thick if allowed to stand will make saw logs in a few years and spruce makes a valuable timber. Mr. Chapin also gave the experience of Mr. Cheever, the editor of New England farmer, on a rocky pasture where, when a boy he was kept mowing brush to keep them down. When he became the owner he let them grow and in 25 years sold it for \$60 per acre. Mr. Tollman said a few years ago while cutting scrub spruces in a pasture there was a half acre covered very thickly. These were allowed to stand and to-day the trees are from three to six inches in diameter and from 15 to 40 feet high.

Chairman Cooke owned a piece of land which was cut off when he was a boy. Beech, birch and maple, were sold for \$1 per cord—to-day there is a sugar orchard of 1200 trees. Thirty years ago he owned a back pasture surrounded by woods. He kept the brush cut for 15 years and since then left it to grow. He can now cut fence rails from it and some logs.

Mr. Sanford of the Board said : The owner of lumber lands should be a practical man and cut off timber as soon as it is ripe. One can cut once in 30 years ; wood land should never be burned. He had seen them burn off the brush after the wood and timber were off. A man who does this knows nothing about forestry ; it



destroys seed and it will be years behind in being covered from what it would if left without the fire

Mr. Fay of Hardwick—Ten years ago bought 10 acres of wood land ; had cut fire wood for the furnace every year some and there is more wood on the land to-day than when he bought it. When scrub spruces get into a pasture it either means war or abandon your pasture.

## HORSES.

---

### WEYBRIDGE INSTITUTE.

Mr. E. C. Ryder, a prominent horse breeder in this section of the State read a paper on the horses of Vermont, which was listened to with much interest. He said Vermont is the only State that could ever boast of a Hills' Black Hawk or an Ethan Allen. Their equal was never produced in the world. This subject should be discussed by some of the members at every meeting held in the State. The horse is the most profitable animal that can be raised on the farm and affords the most pleasure and satisfaction. They will always have a place in Vermont agriculture and the supply of first class drivers has never been equal to the demand. The best horse market in the world is Boston and New York and we are near them. There is also a large foreign demand for our best stock. Am glad to say the interest in horse breeding is steadily on the increase and we are raising a better class of horses than ever before. We look for and expect the market for such stock will increase year by year. Breeders must begin at the top to breed, that is to breed from the very best sires and dams. Life is too short to begin with poor stock and ever hope to become a successful breeder. Should know all about breeding and rearing. Speed is one of the most attractive features of the horse, but it is the height of folly to breed for this alone. Roadsters are always in demand. Beauty should be a leading feature in breeding. A speedy horse with no beauty is not attractive. Avoid breeding to unsound animals; it is different with horses than with other animals. Sheep and cattle may be sent to the shambles if they have a blemish, but there is no demand for horsemeat in this country. There is no more trouble in breeding what you want in horses than in any other stock. In and in breeding may be indulged in to a certain extent, but it requires good judgment to succeed. The State should pass a law to prohibit the use of inferior stallions. The dam transmits fifty per cent of her

characteristics to the foal, therefore the necessity of obtaining a well-bred mare for breeding purposes. The cry is now for a standard bred horse, but he must be backed up by merit. There are always men of wealth who stand ready to pay high prices for fine drivers and the raising of stock horses should receive as much attention from the farmers as any other animal industry. The Morgan horse possesses the most intelligence and endurance of any breed known. They may weigh in the barn no more than 900 pounds, but they seem to increase in weight with every strap and buckle you put on them. The Morgan has done much to make the American trotting horse what it is.

#### MORRISVILLE INSTITUTE.

Gov. Hendee being called upon said : It is after nine o'clock and I am not allowed to be out much after that time. I have watched these proceedings with much interest and have heard nothing about the horse. This subject should be discussed if done properly and in the right way. Farmers can make more money on them than on any other stock. It costs no more to raise a colt than a steer up to three years old, and a colt will be worth from \$75 to \$80 and a steer from \$30 to \$40. A colt needs no more care and less to eat. Our pastures are suitable for this business. If our farmers possessed good mares the mare could work and raise a colt. Much more attention should be paid this industry. This country is looked upon as the place to raise the best. Vermont has the reputation of raising substantial, sound, good-dispositioned horses. If you happen to have one that is fast, sell him ; don't put him in the hands of a trainer, but sell him at a fair offer. I am a lover of a horse. I like a Morgan horse ; they make a good cross with the larger breeds. Every man who has a small mare should breed to a horse of a larger family. I like a Morgan horse to drive but a larger horse to sell. My friend Powers wants a horse for home driving and safety, and if his 27-year-old horse stays in the barn three days he dare not ride after it until his wife has driven it a day or two to take the wire edge off. For home driving or to plow or harrow give me a Morgan, but for the market a larger one.

## MAPLE SUGAR.

---

### CALAIS INSTITUTE.

A. M. Foster, of Cabot, gave a pleasant discourse on maple sugar. He said: Stick to the old rules of cleanliness and dispatch, use pumice stone to clean evaporators and be sure to keep them clean. The sooner you boil sap the better ; it spoils by keeping. Use the thermometer to tell how long to boil. Nitre forms the fastest from 212° to 219° and some after that. We can make the best sugar from thick syrup and can settle out the impurities better. Some men ought to be indicted for *tree slaughter*. Paint the tubs and holders, boil the sap fast and don't stew it. You can get the best sugar at the middle of the season. Use some lime or other alkali in cleaning sugar tools. This was one of the best treats of the meeting, as Mr. Foster divided his samples at the close of the service.

### MORRISVILLE INSTITUTE.

Mr. Gilmore said : He had sent pure sugar to market and had it called adulterated. Mr. Smith of the Board said : Maple sugar is the one crop in which Vermont leads all sister States and is an industry which ought to be fostered and encouraged. Hoped there would be an exhibition of it at the World's Fair in Chicago, as that city turned out more " Pure Vermont Maple Syrup " than Vermont itself.

Mr. Sanford of the board : This bounty on maple sugar is going to give the industry a boom. Already in the southern part of the State new camps are being started. A good article will always command a good price. He spoke of the maple sugar exchange at Brattleboro and of its being a safe and profitable way to put our product upon the market.

Mr. Chapin : Sell my sugar to customers. It pays only to make a good article. As soon as the buds start better gather the buckets,

## WESTMINSTER INSTITUTE.

Prof. Cooke told farmers much about the maple sugar bounty. He reminded them that it was one of the most misunderstood measures that men ever enacted. In the course of his explanation he said that 66 inspectors will be appointed for this State. They will be centrally located at shipping points for convenience sake. The product can be shipped at any time in the season. The inspector will take but a sample and put his seal on the package. It can then be shipped anywhere. The balance of the crop will be inspected at the homes of the holders of licenses, after sugaring is done. The samples taken out of the packages will be analyzed afterward at Montpelier by a government chemist and when his work is done and report made the bounty will be paid. The bonds are a mere matter of form and the provision was imposed because of the southern planters, whose bounty will be so large. About 2,500 licenses have been taken out, but those who have failed to take out a license already can not secure a bounty on next season's crop. In anything which may hereafter arise there will be no expense whatever to the makers. The inspectors simply draw small samples of sugar, not a whole package, and a government chemist will attend to the analysis. The bounty will be paid only when 500 pounds are made testing 80 degrees or over. This point will have been reached when the syrup is taken off the fire at 235 degrees. A larger proportion of the sugar now made by Vermont farmers will test over 80 degrees and is, therefore, sure of a bounty. For syrup at 11 pounds to the gallon take off at 219 degrees. A gallon of syrup weighing 11 pounds will make 8½ pounds of sugar testing 80 degrees and drawing a bounty of 15 cents. These are the main points and will tell farmers just what must be done to secure a bounty. The maple sugar maker who does not take out a license stands in his own light and depletes his own purse just so much.

## WILMINGTON INSTITUTE.

E. A. Fitch ; The greatest industry in this section is the manufacture of maple sugar ; more money from this crop comes into town than from any other. To have a good sugar house is the

first thing to be thought of and the boiling apparatus next. Prefer to reduce to a 10 or 11 pound syrup in the woods, settle in large tanks and can from the top ; if put up in cans hot it is not as liable to grain. The best way to retain the maple flavor is to seal the syrup in tin cans ; this can be taken at any time and made into cakes or soft sugar, as you wish, and have a perfectly fresh taste. Our merchants buy and seal in 50 gallon tins and keep in that way. Our experience is that it keeps better in this way than any other. I am selling syrup to-day for \$1 per can and sugar cakes for 15 cents per pound. If syrup is put up cold the cans should not be filled full as the heat would expand the cans.

Mr. Smith of the Board : The taste of the consumer is not educated up to the nicety of the article ; had known instances where sugar had been sent back from market as adulterated when it was absolutely pure.

Mr. Fitch said the same.

Mr. Sanford of the Board : That our sugar has a reputation as being the best is shown from the fact that they steal our name to put on the adulterated article.

## MEADOWS AND PASTURES.

---

CALAIS INSTITUTE.

In his paper on "Care of pastures and meadows" Mr. Chapin said: Grass is the great crop of Vermont. Nine-tenths of the cleared land is in grass. Our pastures in too many instances are growing poorer. On the steep hills and mountains where they have been washed out and fed for a hundred years they had better grow up to brush and return to forest again—they have done their work. Where they can be plowed it may be in some instances best to do so and fertilize, but not always. It pays in some instances to sow ashes or ground bone and in others grass seed; but we are drifting into the soiling system. We should keep the brush cut and mow the brakes two or three times a year. It is a good idea to stock pastures heavily and soil them. Our mowing lands are of much more consequence than our pastures. They are growing better, and we should continue to improve them. Keep them smooth and fitted for the machine. We need no shade trees in them and should allow no stumps to remain. We should allow no stock on the mowings and need no fences. Allow no springs to make wet places; underdrain them.

I seed with 19 pounds of timothy, 15 of clover, 3 of alsike, 2 of white clover. This gives good results. Grass green or dry is the cheapest feed we can use; would cut early; grass cut early does not run out as quickly as that cut later, especially when allowed to go to seed. Our farms would pay better if we farmed it more intensely and made our lands cut three tons per acre at two clippings.

Mr. Bliss—How deep do you drain?

Mr. Chapin—From  $2\frac{1}{2}$  to 3 feet deep. Be sure you go deep enough.

Mr. Sanborn—Which is the most effectual way to drain, with stone or tile?

Mr. Chapin—I never used tile. I get rid of the stone on my farm by putting them into ditches; lay a throat and cover with flat stones, after which fill in with smaller stones.

Mr. Dwinnell—Would you feed the grass after haying or mowing it?

Mr. Chapin—I would mow it and feed it out. I would not allow any to go to seed if I cut it and left it to rot on the ground.

Mr. Leonard—How about manuring sandy soil?

Mr. Chapin—Would put it on often.

Mr. Snow—What is the best seed for pastures?

Mr. Chapin—All kinds of seeds. The orchard grass is a good pasture grass.

Mr. Smith—When would you sow orchard grass for pasture?

Mr. Chapin—Any time.

#### ENOSBURGH FALLS INSTITUTE.

Mr. Sanford answered questions as follows:

Best thing a young man can do is to start farming in Vermont now, villages and cities are filling up and the consumers are increasing faster than the producers.

Dairy farms will improve in value if the manure is all saved

I have very little faith in land that grows brakes and will not try to reclaim it.

Mr. Geo. Fassett said: I have killed brakes entirely on knolls by sowing plaster, and clover will come in very rank after such treatment.

E. J. Vilder North Sheldon said: I have had similar experience in ridding land of brakes.

A. A. Reybon said: Brakes grow on both good and poor land. Mr. Cumming of Berkshire and Geo. Fassett of Enosburgh Falls said the best potatoes they ever raised were on brakey land.

Mr. Vail of the Board said: There are a great many kinds of this plant. Young ladies and city people call them ferns, but the farmer calls them brakes. My experience with the large brakes is they can be killed by plowing and manuring; can grow large corn with plenty of manure where the large variety grows, don't think it necessarily follows that land that produces brakes is poor. Our



pastures on the hills are growing poorer every year and there is no way to enrich them but by plowing and putting on fertilizers. If you could plow and reseed they could be reclaimed.

Mr. Baker said: The trouble with our pastures is, the best grass is all eaten off and never allowed to go to seed; would sow seed in spring when frost is coming out; sow a mixed seed, both early and late grass; have been successful in seeding in this way.

E. C. Burt seeds his pasture once in four years and uses no fertilizers with satisfactory results.

B. F. Fassett reports that he has been successful in killing brakes by mowing repeatedly.

## POTATOES.

---

### GRAND ISLE.

Prof. L. R. Jones of the Vermont Agricultural College gave an instructive talk on the prevention of blight and scab. It was more particularly directed to the fruit growers. His lecture was illustrated by charts, from which he explained how the disease was propagated by spores or seeds from one plant to another and how it could be prevented by spraying.

Nature intended all plants and grains should produce perfect fruits, and when it does not, we should inquire into the cause. Parasite trouble is the least understood and causes the most trouble. Mould on bread is one example of this kind; scalding kills the spores. Fameuse apples are more liable to be troubled with scab than other apples. Mixture for spraying costs about four-fifths cents per gallon; will take from one and one-half to three gallons of this mixture to a tree; should spray from three to five times in a season for scab. Mr. Kenney said he thought spraying would kill scab but it was expensive work to do it.

Potato rot is caused by a blight on the vines and can be cured by spraying with Bordeaux mixture. This particular fungus grows on no other plant and lives through the winter in the tubers. If we could get rid of all affected potatoes we could get rid of the disease. It spreads from leaf to leaf and through the stalks to the tubers. Difference in different kinds of rot is caused by the different degrees of moisture. Scab is produced by a germ brought on by the condition of soil. The fungus is developed in land heavily manured; also can be propagated through the seed. It would be a large problem to give all the causes of or reasons for scab on potatoes.

## POULTRY.

---

### FAIRHAVEN.

George H. Northrup, of Raceville, N. Y., read a very instructive paper on poultry. He said: Poultry rightly managed was the most profitable stock kept on the farm. He had a flock of 175 hens and found both pleasure and profit in the care and management of them. He said a dozen of eggs could be produced for less money than a pound of pork or beef, and eggs were seldom worth less than 10 cents and often would bring more than a pound of butter. Thinks he can get more profit from eggs than poultry.

Fowls are good economizers on the farm. They destroy a large number of insects and utilize much that would otherwise go to waste. Turkeys, ducks and geese have their places, but hens are the most profitable. The fertilizer from the hen-house should not be overlooked as one of the profits. Too much is often expected of a flock of hens for the amount of care they receive. No stock will thrive without proper feed and care. It is natural for hens to produce eggs and if in warm and light quarters, with proper feed, will do so. Quarters should be made tight, roomy and warm and should have an open shed adjoining the hennery to run in during the winter days. Do not have too much glass in building, and windows should be low down instead of at the top; glass admits cold after sun goes down. Food for hens should be of the bone and muscle forming quality and not too much fat. My feed in the morning is as follows: two bushels corn, two bushels wheat, one bushel oats, one bushel barley, some shorts ground together wet with hot water or milk and fed warm, just what they will eat; beef scraps should be added; warm water for them to drink. Much prefer thoroughbred fowls. The care and feed for one kind of fowl might not be best for another; get your hens all the same breed and they will require the same care and management; has paid considerable attention to thoroughbred stock. Use incubators to hatch chicks; should breed for special purpose.

---

MORRISVILLE INSTITUTE.

The chairman called upon Mr. Beecher of Johnson to give his experience with hens.

Mr. Beecher—I have always believed in mixed farming. Kept an account of 16 hens a few years ago and they laid 1648 eggs. We sold 1100 for \$20. Since then we keep about 60. Have no hen house; they run about the barn and roost in an open shed. Sold in one year \$101.79 from them, besides what we used in the family. We raised pullets enough to keep the flock good, and killed and ate the young roosters. Feed a 12 quart pail full of warm feed in the morning, consisting of 1-3 bran, 1-3 fine feed and 1-3 corn meal and some boiled potatoes. The hens eat a bushel of oats in about four days; feed very little corn; never pay out over \$30 or \$40 for them. Do not like the Plymouth Rocks; prefer the Brown Leghorns. Keep lime and sand by them all the time.

## WEYBRIDGE INSTITUTE.

Hon. William Chapin of Middlesex had for his subject, "Farming for Profit." He said that every farm kept more or less poultry; in many instances poultry was more loss than profit, but if rightly managed would be a source of profit. Broilers are also in demand in their season and command fancy prices. Hens need a warm room with southern exposure; one square yard to a fowl is the best rule to be governed by in regard to room; feed a variety of grains and a warm mash of bran and vegetables in the morning during the winter. April and May pullets will, if kept in good quarters and with proper feed, lay all winter.

## SHEEP.

---

### CALAIS INSTITUTE.

Mr. Spear said in regard to fine wool sheep—Men find themselves peculiarly adapted to special business which perhaps their neighbors could not succeed with and with a diversity of industries perhaps the fine wool sheep may find a profitable place on some farms to-day. The thought of fine wooled sheep associates itself with the thoroughbred; each class of sheep must be adapted to its surroundings. Middle wooled sheep may perhaps be the most desirable. For a hundred years or more in our State the fine wool has been the sheep of her history. No other breed will run in so large flocks. They are the longest lived sheep known. Other breeds live to about six years, the fine wool from ten to twelve years old. As wool-bearing animals they are the distinguished sheep of the world.

Mr. Chapin said of the mutton sheep—This is one of the most pleasant and profitable industries of the State. The old way of rating the proceeds of the flock was the wool first and the lambs as the incident, but now it is the lamb first and the wool as the incident. I can raise sheep with profit if I do not shear them at all. The mutton lamb is a very elastic animal. My sheep pay me about \$7 per head, viz., \$5 for the lamb and \$2 for the fleece, and I can keep 10 of them where you can one cow. They are very profitable.

Mr. McElroy of Middlesex raised from 16 ewes 32 lambs, and Mr. Gleason of Barnet raised 42 lambs from 20 ewes. Cotswolds require a strong fence and tight and are very apt to be unruly.

Mr. Walker asked if fertility can be kept up on a farm as well with sheep as with cows.

Mr. Spear—Sheep that come into the barn in good condition will need no grain. October and November are the trying months for the sheep, the frosted feed is not good for them. It will pay to feed grain in October and November.

## GUILDHALL INSTITUTE.

In the evening Mr. Spear spoke more particularly on the profits of sheep raising in the State. He said 40 years ago Vermont had 1,000,000 sheep and the average fleece was  $3\frac{1}{2}$  pounds per head; 10 years ago there were only 400,000 sheep in the State, and he presumed when the census of 1890 was out we should find we had no more sheep than cows. Cattle have increased in number and horses have nearly doubled, but sheep have decreased. Forty years ago wool raising was the only product thought of among the sheep farmers. Mutton was then comparatively little used. The market did not demand it. Now, however, we are approaching nearer and nearer the English custom and mutton is in demand. No meat is now in as good demand as mutton and it commands good prices. No branch of farming in the State looks more favorable at present than raising mutton and wool; they have a home market and that is the best kind of market. Thirty years ago the market demanded washed wool, but now the quotations are entirely on the unwashed.

Mr. Smith of the Board said: Vermont was never more prosperous than when her hills were covered with sheep, and thought that at the present time mutton sheep under the right management could be made to pay as well as any farm stock. There are large amounts of pasture in the State that have been allowed to go to common, that with little trouble might be made to keep sheep to a profit. One trouble with our best breeds of mutton sheep is they will not flock like the merinos, but do the best where they are in lots of 20 to 30. The dogs are another drawback on this sheep husbandry. The latter increase as the former decrease. It is said that Angora goats will mate with sheep and will protect them against dogs.

Mr. Vail asked: What is the effect of keeping the mutton sheep in large flocks? Mr. Spear answered: It is true that mutton sheep will not flock to so good an advantage as will the fine wools, but a half breed will and they make good mutton and sheer a good fleece of marketable wool.

On the western ranches the basis of the herds are the Mexican sheep which are the hardest animal of the sheep kind, and one

cross of the Merino does not diminish their hardiness to any noticeable degree.

Prof. Cooke said: How many sheep do you calculate will eat as much as a cow?

Mr. Spear: Seven coarse wools or ten fine wools will eat about as much fodder as the average cow. It will take 20 tons of hay to keep 100 fine wool sheep.

Mr. Walbridge said: Fifteen years ago there came into my possession a 40 acre lot of land that was covered over with daisies and golden rod. The former owner had allowed it always to stand till after haying before he cut it. He changed and cut it in June and made a hay which was readily eaten by both sheep and cattle; has since turned it to pasture for sheep and all the foul weeds have disappeared. My sheep are Cotswold and I have always bred to a close wool ram; think a firm fleece better than a long thin one; have bred them long. My sheep shear nine and one-half pounds and my April lambs weigh in the fall about 90 pounds. I feed no grain; believe in clover hay cut early when full blown; put in green and not too dry and mix straw with it; straw absorbs from hay and is all eaten; no need of roots or grain with that kind of hay. Lambs that come last of March or first of April are ready to market early in July. Sheep have been neglected in the State. Our pastures would have been better if we had kept more sheep. Brush land may be cut and burned over and re-seeded and make good pasture. Dairying has a tendency to run out our pastures. Merino rams crossed with Cotswold ewes make a good sheep; will weigh 125 pounds and are hardier than any other breed. The best topic for farmers to discuss in Essex county is sheep.

Mr. Chapin prefers the Downs to the Cotswold; thinks they are less liable to be unruly and are more hardy.

Mr. Spear in answer to Mr. Walbridge: My sheep are from Merinos; shear from 10 to 12½ pounds of wool per sheep; my wool clip for the past 10 years has averaged \$2 per sheep. Merinos shear the most wool; good demand for medium wool. Vermont fine wool cleaned brings 60 to 65 cents per pound.

Prof. Cooke: Pastures seem to grow poorer and the cause seems to be the taking away of the sheep. Cows do not like to

eat brush, are the poorest animals to cleanse land and sheep the best; they nibble the young shoots. The hog is a good animal to kill out brakes; they feed on the roots and will clean out a pasture of that kind of plant, and will enrich the land by stirring up the soil. Many acres of our pastures should never have been cleared and should now be allowed to grow up to wood again. Better concentrate our labors on our better lands and let some of the hills go.

## RYEGATE INSTITUTE.

During a discussion on pastures and sheep, Mr. Ricker asked how many sheep Mr. Spear kept in a flock. Mr. Spear—With my fine wool sheep about 150 in summer and a less number in the winter.

Mr. Cloud Harvey—Why do you keep fine wool sheep and advocate the raising of coarse sheep to others? Mr. Spear—My flock is the result of more than thirty years labor in breeding. We have a special market for the most of our stock, but I think for the past twenty years grade mutton sheep have paid as well. My objections to Cotswolds are they are not as hardy and are more subject to disease than the Downs and they do not mature as quickly.

Mr. McLane—Are they not more apt to become unruly than other sheep? Mr. Spear—Do not feel like saying that. Think they are influenced more or less by their bringing up. The Leicesters are the most liable of all sheep to be unruly.

Mr. Harvey—What is the cost of producing a pound of wool? Mr. Spear—That depends upon circumstances. If we raised no lambs and the wool was the only product it would cost in the neighborhood of 50 cents per pound. With well-selected and well-cared for flocks the wool will cost nothing. The lambs are the medium of profit; coarse wools are the best for mutton; Shropshires are the heaviest shearers of any mutton breed.

Rev. Mr. Harris—Do you know anything about the sheep trust that was organized in the West a short time ago?—Mr. Spear—Am not acquainted with its workings and would look upon it with distrust. Board fences are the best for sheep and wire the worst. For fine sheep on our back pastures a brush fence is sufficient.



Mr. Buchanan—Do coarse sheep need a warm place? Mr. Spear—I prefer a well protected shed with a yard but others have good results with wintering them in close sheds. Mr. Cochrane—Sheep are close feeders; grass is sweeter when kept fed off closely.

Mr. Ricker—What do you do for ticks?

Mr. Spear—Have no trouble with ticks with my fine wools; foot rot is the pest of those. For coarse wools a dip of some kind will kill ticks; they are the worst in winter and should be killed some way when they come to the barn.

Mr. Cochrane—The earlier coarse lambs are fitted for the market the more they will bring; best prices are in May and from that to July; those not marketed then should be kept till fall and fed through the winter. Mr. Spear in answer to a question said we raise about 75 per cent of our fine wool lambs. It costs about \$5 per head to ship them to Montana and they bring from \$15 to \$20 per head.

Mr. Gilfillan was asked to tell what his sheep paid him. He said that in 1889 he kept 10 ewes and if he had sold all the lambs they would have brought him \$80; wool brought a little less than \$2 per head; lambs weighed 92 pounds each; are grade Southdowns; many ewes raise two lambs.

William Gleason of Barnet said: We keep 25 sheep, pure Cotswold; have sold some years \$300 from them; they shear 12 to 14 pounds of wool per head; lambs are dropped in January and February; lambs 10 months old will weigh 150 pounds; always keep in a warm shed; use fly powder to kill the ticks; feed two bushels of ensilage and hay twice a day; sell buck lambs in June at from \$5 to \$6. Mr. McLane—Raised from 11 ewes 26 lambs which averaged 98 pounds each. Mr. William Gleason of Barnet—Raised from 22 ewes 42 lambs. Charles Adams two years ago raised 12 lambs from 8 ewes; lambs and wool brought \$66; last year 11 lambs brought \$45.

Mr. Cochrane likes to keep a few sheep; thinks they improve the pasture; they will keep the rye grass down and enrich the top or upper part of our pastures; sheep should be found on every farm in Vermont; do not like to let my sheep run in the pastures with my cows.

## WESTMINSTER INSTITUTE.

Mr. Spear spoke on sheep.—Fine wool sheep were once the one product. The flocks kept then were for wool and wool clip was the one cash product. Nothing else of importance was cash. Butter and cheese were for barter. Farms were paid for from the products of the wool clip. The change from sheep to cows came about at the close of the war. It was simply because they had got used to high prices and when at the close of the war prices began to drop they thought the business had had its day, and kept changing until Vermont lost the sheep and took up with the cow. Westminster was once famous for its sheep and a few are still left. It looks now as though the industry was coming back to take the place lost in years past. The outlook at present is favorable for the return of sheep in view of the value of the mutton product.

There are a number of reasons for the belief that the industry will return to us. One is the work, as now conducted, does away with the extra labor needed in the dairy. In spring the extra care and shearing should be incidental. After that the flocks go to the hills to stay. They need no soiling and are able to get their living from hill pastures. Many pastures have been lost because they have had no sheep running upon them. Sheep may not restore fertility, but they will maintain it. It is a relief to the home. Creameries are doing this to some extent, but sheep husbandry is doing away with the hard work and helps to make farming attractive. Third, keepers of sheep are able to supply the wants of their flocks from the farm. If fattening he may need to buy a small quantity of grain, but otherwise he can raise sufficient for all needs. Grain is the best value for flocks when fed after feed in pastures has become frosted slightly. In doing so the sheep will get great benefit from the grain. Breeding stock should have some grain before the birth of lambs. Sheep do better without grain in December, January and February.

Everything is now tending in the direction of mutton, and it is true that there is no meat so healthful and nutritious. If there is any product for which the demand is greater than the supply we ought to take advantage of the shortage to increase our own in-

come. The breeding of stock for mutton is the end aimed at now. How it is to be brought about is the great study. A small flock for mutton pays a profit earlier and quicker, but a small flock does not go far toward bringing up a farm. Fine wool sheep are the foundation to breed lambs from and additions to flocks is a part of their numerous benefits. The fleeces should not be neglected. When our fathers got three pounds of wool a head, they thought they were getting a large yield and it certainly paid them a profit at 45 cents per pound. The average now is eight pounds a head and from 22 to 25 cents is the price per pound.

Increase of wool product is an element to be seriously considered. It costs as much to keep 75 coarse wools as it does 100 fine wools while the product is in favor of fine wool flocks. They are the most hardy ever produced. They mature late and last longer. The advantage in favor of fine wool sheep as compared with dairying is very great. Ten cows must make \$37 each to offset the work of 100 fine wool sheep. I fed the pomace from a cider mill and secured very satisfactory results. I fed it in the fall and into the winter. I put it into a silo made of double boards with paper between, built at a cost of \$15. The pomace is as sweet now as it was in the fall. Sheep eat it more greedily than grain. I feed 80 sheep five bushels. Pomace is valuable for sheep and the dairy. Tests place it at seven dollars per ton, or twice the value of corn silage. It is a waste product and is cheaply housed. Calves and pigs won't offset the lambs. Skim milk as fed now is estimated at from five to seven dollars. If we were to put skill against skill between dairymen and sheepmen the sheepmen could tell as big stories as the dairymen.

Following Mr. Spear, Mr. Chapin talked on mutton sheep, confining his remarks to the coarse wool varieties. He said Mr. Spear advised the mixing of fine and coarse wool bloods, but I do not like mixed breeds. They always develop the bad qualities of both without retaining a good quality of either. Mutton sheep of the Cotswold type give the best combing wool grown. I once sold a lamb of this variety for \$13 and it weighed 120 pounds. The Merino always needs help; can not get up alone even. The lambs of the coarse wool varieties are strong and even dance without

music. They are cheerful and grow fast. Sell the lamb at ten weeks old and let the ewes get fat. It is possible to raise two crops, but I do not deem it advisable. Always have a shelter for them. It is a good time to sell in September when they are as fat as they ever will be. Sell in first of the winter, if you wish, after feeding a little grain. A friend of mine in Caledonia county sold some the other day for seven cents a pound that weighed 130 pounds.

The coarse wools are great breeders. One man reports 32 lambs from 16 ewes and another 42 lambs from 20 ewes. Sheep are just like children. You can educate them any way you choose. When you turn them out fix the fences, not high for they won't jump high. I build mine with two boards below and two wires above. When you turn them out boil up tobacco in a caldron and when strong dilute with water enough to dip a sheep. Then put in three or four quarts of salt and the same amount of soft soap. Dip the sheep and the lambs, turn out and let them stay until December. Do not have more than 25 to 30 together. They won't do as well. Keep a few hundred if you wish, but divide them up into small flocks.

Mr. Allen asked: What kind of a sheep will give you 30 or 40 pounds of wool?

Mr. Spear: Merino rams shear very heavy; I had one that sheared 35 pounds of wool at 365 days growth, and it is not uncommon to find ewes that shear 18 to 20 pounds; there are flocks in Addison county that shear 17 pounds on an average. Cotswold are considered the most breachy, but in my vicinity where there are some of this breed farmers have never had any trouble. The most successful mutton lambs can be raised from the Merino crossed with a mutton ram. Grade Merinos will run in a larger flock than full blood mutton sheep. Sheep can be kept summers on back pastures where you could not turn cows.

Mr. Fitch: What about the sale of wool, how do you get \$2 per fleece?

Mr. Spear: The Merinos are the heaviest shearing sheep. If you want more money for the fleece you must cut more pounds; my sheep shear 12 pounds; Cotswold will average 8 to 10, Shropshire less.

Mr. Hubbard: Will sheep run a pasture out? Mr. Spear: No, I have a pasture that has kept sheep 50 years and is good now; no stock ever kept pasture so good as sheep; they will eat the underbrush and tend to keep the land free from weeds.

Mr. Mann: Should not sheep pasture be kept close? Mr. Spear: Yes, any pasture is better to be kept close.

Mr. Fitch: Do you advise keeping any other stock in pasture with sheep? Mr. Spear: Yes, I would advise a mixed stock.

Frank Mann: What temperature do you keep your sheep barn? Mr. Spear: Unless the weather is very cold do not shut the doors nights; keep them dry with good air and not too warm.

Mr. Adams: How much room do you calculate for a sheep? Mr. Spear: about 15 square feet.

Mr. Allen: What about feeding roots or ensilage? Mr. Spear: Have never fed ensilage; feed turnips and a great deal of apple pomace and am well pleased with the results; the best grain for sheep is oats.

## THE FARM.

---

### MORRISVILLE INSTITUTE.

Judge Powers being called upon to make a few remarks, said : I have attended nearly every session of the meetings and am getting to be quite a farmer in my feelings. I belong to the consuming class and we are all interested. If you are depressed, we are depressed. Every gentleman who has spoken seems to convey the idea that more brain work and not so much muscle is needed in our agricultural pursuits. My observation is that those farmers who make the most study of their business succeed the best. The depression in agriculture is felt just as much in any other business and it is all due to the same cause, extravagance. Some men make money in a hurry, but the wealth that counts comes slowly and by degrees. We all live too fast and too expensively. I saw in riding through a town with a gentleman where we kept actual account twenty-one top buggies, and in many instances the roof of the barn was falling in. At other places an organ was heard in the house. Instead of fixing up the barn they had spent money for things they did not need. Every man's daughter can be an organist. The farmers do not all do as I do—ride in a sleigh 34 years old and drive a horse 27 years old—but prefer like my friend, Gov. Hendee, a new horse once in two weeks, and a new sleigh twice a winter. The first grand secret is to know how to earn a dollar and the next to keep it. It was a magnificent thought of our legislators when they created the Board. The thousand and one hints dropped here, both from men from abroad and at home, are worthy of our best consideration.

### RYEGATE INSTITUTE.

W. N. Gilfillan said in substance: Business interests of all kinds flourish or decline in proportion to the amount of thought and study put into them. We are living at a time when constant change is taking place, and where farmers have not succeeded the

reasons are obvious. They have not kept pace with the times. Human nature is the same the world over and every one looks out for himself. Every other interest except agriculture seems to be protected and is flourishing. The Board of Agriculture should call the attention of the farmers of this State to the fact that they must study more, or the interests of the Vermont farmer will be pushed one side. Farmers are beginning to see this and demand attention; unless a remedy is found the future of Vermont agriculture does not look very favorable. Our farmers have helped too much to work up the Western boom. Our young men have been induced to go to Kansas and other Western States, and have suffered more privations than the early settlers of this country ever did. I hope the Board will preach harmony among the farmers all over the State, as that is one of the prime necessities of success.

Mr. Chapin spoke on "Farming in Vermont." I want to say a few words about what has driven people from Vermont. The papers say farmers are happy, we have so large crops. If this is so we had better take advantage of it and stop some of the leaks that have been made when we were not so prosperous. We are commanded and we do get our living by the sweat of our brow, but the trouble is too many other people get their living by the sweat of our brows. Farming pays an income of about  $1\frac{1}{2}$  per cent on the capital invested; manufacturers pay four per cent and banking from 10 to 20 per cent. Now the laws should be changed so our taxes could be equalized; where the banker pays 70 cents tax the farmer pays \$1.30. I do not know why railroads should pay 7-10 of one per cent, or on their income as they may elect; while the farmer pays as assessed by three men, while the railroad has only one to assess them.

We need different methods in working our roads. We waste money on the roads. This old-fashioned method of fixing the roads is a shiftless one. Good roads are one of the needs of our farmers. Another waste still greater than roads is our common schools. We pay \$723,000 per year for tuition and there has been more than half a million each biennial session for the last decade. Our smaller schools should be abolished and larger schools are much more profitable than smaller ones. There are 500 schools in the State with only

about five scholars each. Boys leave the farm more for the reasons that farmers are not recognized as much as people in other occupations. They get an idea that they cannot be anybody if they are farmers, and it is time for us to wake up and educate ourselves and our children. Natural science should be introduced into our schools. Plant growth should be taught and made familiar to our children. Our sons should visit the Legislature and courts and conventions. Science of government should also be made more familiar to all young people.

#### WILLISTON INSTITUTE.

Mr. Chapin in discussing "Farming for profit" made mention of the different farming industries and how they could be run with profit. He also spoke of the money of the State and how almost all of it had been taken from the soil. Too much of this has been taken to build up business and towns outside of the State and altogether too much of it will never see its owners again.

Mr. E. Whitney said—It seems to me this fault finding and grumbling will not help us out of our difficulty. We have got to work out our own salvation. We need more skill, gumption, study and brains to be good farmers. We live too expensively. Labor is the great hue and cry now. It is just \$64 per year more than 30 years ago and butter is worth one-third more now than then.

Mr. Chapin—A man bought a farm last year and paid one-half of it from crops the past season.

Mr. Watson—Think farming can be done at a profit. The general opinion is that grass is the main crop. I know of farmers who can make one pound of butter per cow a day on early cut hay alone.



# THE ATTRACTIONS OF VERMONT.

---

At the close of the series of meetings of the Board of Agriculture for the winter of 1890 and 1891 it was decided, after a careful consultation, to do something in the way of advertising the resources of Vermont. The work was performed by Mr. Victor I. Spear, and Mr. Homer W. Vail, both members of the Board of Agriculture. A large number of blanks were sent out and much information of a very encouraging character obtained. The whole was printed in pamphlet form, of 110 pages, 5000 copies of which were printed for general distribution, and over 15,000 copies were issued in newspaper form, and mailed to subscribers in connection with the county newspapers of the State.

The same general plan was followed in a subsequent pamphlet published during the summer of 1892. The following pages are extracted from these pamphlets.

---

## VERMONT.

---

HAIL, thou Green Mountain State !  
Home of the good and great  
Of by-gone days !  
Thy patriot's honored name,  
Thy hero's deathless fame,  
Thy sons will loud proclaim  
And sound thy praise.

CLOTHED in their living green,  
Thy noble hills are seen,  
Our boast and pride ;  
There, winds with praise resound,  
There, wild flowers sweet are found,  
And peace and health abound  
On every side.

---

PIERCE was thy long campaign,  
For liberty to gain  
A sure repose.  
Thy banner wide unfurled,  
Thou did'st "defy the world,"  
And thy stout weapons hurled  
'Gainst all thy foes.

HAIL, then, our loved Vermont!  
Freedom's baptismal font  
Was reared by thee ;  
Still may its waters bless  
Thy sons, who would possess  
Truth, Courage, Holiness,  
And Liberty.

—*St. Johnsbury Illustrated.*

## VERMONT AS A PLACE TO LIVE IN.

---

It has sometimes been said that Vermont is a good State to emigrate from, but when the advantages of her situation, soil, climate, water, production, and people are fairly considered, when we take account of her moral, social, educational, and political privileges, her facilities for manufacturing, her nearness to the great markets of the world, her abundant means for the safe and rapid transportation of her products to the great business centres of our country—when all these and many other circumstances in our favor are allowed, it may safely be said that *Vermont is a good State to live in*; that here a person may find that environment most conducive to those fundamental principles of “life, liberty, and the pursuit of happiness”—life fully rounded out, from healthy and happy childhood, strong and useful maturity, to serene and contented age—liberty the freest and purest—and in “the pursuit of happiness” a reasonable prospect of success. Let us consider, in their order, a few of the most conspicuous advantages of the State.

### SITUATION.

Vermont is in the northwest corner of New England, lying between Lake Champlain and the Connecticut River, extending from north latitude  $42^{\circ} 44'$  to  $45^{\circ}$ , and from east longitude  $3^{\circ} 35'$  to  $5^{\circ} 29'$  from Washington. Length of State, north and south,  $157\frac{1}{2}$  miles; average width, east to west,  $57\frac{1}{2}$  miles. Area,  $9,056\frac{1}{4}$  square miles, or 5,795,960 acres. Geographical center in the town of Northfield.

Its location, just south of the center line of the north temperate zone, and on the same line of latitude substantially as the great lakes extending from 200 to 1,000 miles on the west, and within 150 to 200 miles of the Atlantic on the east, gives to Vermont the most favorable conditions for a healthy climate and

abundant rainfall, while its situation in the direct line of the natural route of commerce from the West to East has given us abundant lines of railways for the carrying of persons and property to the East or West. In fact, by the Fitchburg, Rutland & Bennington, Central Vermont, Grand Trunk, Canadian Pacific, Portland & Ogdensburg, Montpelier & Wells River, and other lines running through Vermont, a great share of the travel and traffic from the West to East and East to West passes through the State. And through this State also is the natural outlet of a large part of the Dominion of Canada.

#### SOIL.

Vermont has almost every variety of soil, (except barren or poor soil. We have none of that.) Formed largely by the grinding and mixing process of the Glacial Period, or by the disintegration of rocks by the action of the elements, Vermont soil seems to be full of plant food, which, dissolved by the frequent showers and heavy dews in summer, and the snows and frosts of winter, produces abundant and useful crops when properly cultivated. Something always grows here; burn the timber from a mountain top and with it all the soil down to the base rock, and in a few years, by the decay of the rock and fertility from the air, growth begins—first mosses and lichens, then the seeds of trees take root and grow, so that many a man has seen in his own lifetime a second forest grown on the same spot.

But a better proof of the good quality of Vermont soil is given by the noble crops it raises. What are they and how much? The eleventh census figures are not out yet, but any Yankee can easily guess, and be safe that from this same soil we pasture and feed 1,000,000 of cattle, sheep and horses and have hay to sell, and raise annually nearly 67,000,000 bushels of grain and five and one-half million bushels of potatoes. We make some 35,000,000 pounds of butter and 14,000,000 pounds of maple sugar each year. From the forest we harvest \$10,000,000 worth annually and from many other sources the soil yields value and comfort.

## QUALITY AND QUANTITY OF PRODUCT.

Not only in quantity of product, but also in quality, does Vermont far excel in most of her farm productions.

What State produces so much maple sugar, or an article of so fine a flavor or color? What State or country beats the butter producing record of Amasa Scott, of Craftsbury—450 to 640 pounds per year per cow, with a feed of simply green and dried grass, and a few roots? Or that of G. S. Fassett, of Enosburgh—270 pounds per cow, for a herd of twenty, with only \$3.40 worth of grain to each cow? Who in the world beats Luke C. Fisher, of Cabot, who, in 1890, sold from twenty-two cows and heifers 8,270 pounds, or 376 pounds for each animal? Where will you find, except in Vermont, dairy regions like Pomfret and Ryegate, where the annual yield per cow is nearly 300 pounds for the whole community?

In fine wooled sheep, this State easily beats Spain, Saxony or Silesia, in fineness, density of wool and size and vigor of the animal. The mutton breeds, like the Cotswold, Southdown, Shropshire, etc., afford the finest lambs for market, and are very profitable. From a flock of twenty Cotswold ewes Wm. Gleason, of Barret, sold in one year forty-two lambs, that with the fleeces of the ewes brought \$300.

Vermont Morgan horses are famous the world over and need no praise.—“Their works do praise them.”

## CLIMATE.

The healthfulness of our climate is best attested by the strength, activity and full development of men and animals. The snows of our winters make good roads; they even up the rough places, and enable us to get the timber from the hills and mountains. Our elevation and wooded mountainous surface give us pure air, and our springs and sparkling brooks give us pure water. No drouths or malaria trouble this region. On the whole, the climate is favorable to the best productions of the temperate zone.

## WATER AND WATER POWER.

While there are no large lakes or rivers wholly in Vermont, still the State is magnificently watered, and has an immense amount of water power, mostly unused as yet. The range of Green Mountains running north and south through the central part of the State forms the water-shed, dividing the waters that flow south and east into the Connecticut, from those that flow north and west into the St. Lawrence by way of Lakes Champlain and Memphremagog, and those flowing southwest into the Hudson. On the east side there are some twenty streams that assume the names of rivers. These, many of them originating in ponds among the central mountains and flowing rapidly down the eastern slope, afford numerous though not heavy powers for mills. There are also splendid mill sites along the Connecticut.

On the west side of the State the rivers are not so numerous but are larger. The Otter Creek, Winooski, Lamoille and Missisquoi rivers, with their branches, drain the waters from nearly half the State. On the Otter Creek are large water powers at Proctor, Middlebury, Vergennes and other places. The great falls on the Winooski at Middlesex and Bolton are almost wholly wasted for want of mills, while those at Marshfield, Montpelier, Colchester and other points are but partly used. There is much power running idly by on the Lamoille and Missisquoi, and the various branches of these larger rivers. On those streams flowing into the Hudson from the southwest part of the State mills are more numerous. As a whole not one-fourth of the available water power is at this time used at all, and that fourth not fully utilized. While the main purpose of this paper is to encourage agriculture, yet as an incidental benefit to farming we should be glad to promote manufactures. Manufacturing villages and cities give the farmers in their vicinity a home market for their products; they help to maintain government, and make life more social and pleasant. The great need of our State to-day is more manufactures, more people, and more home investment of capital.

## MANUFACTURES.

Although manufacturing establishments are not numerous in this State, yet the success of the scale works at St. Johnsbury and Rutland, the organ making at Brattleboro, the making of pulp at Bellows Falls, Readsboro and Middlebury, the woolen mills at Winooski, Hartford, Springfield and other places, the knitting factories at Bennington, all go to show that fortunes can be made in Vermont in changing the abundant raw materials into forms fit for use.

## MINING AND QUARRYING.

No State is richer than this in ores, marble, granite, slate, limestone, and other useful and durable minerals. Mountains of marble are uplifted all along the west side of the State from Dorset to Isle LaMotte. Valuable quarries are worked in Dorset, West Rutland, Rutland, Proctor, Middlebury, Swanton and Isle LaMotte, with smaller works at many other points. At Fair Haven, Castleton, Northfield and Montpelier are fine slate quarries, while at Barre, Dummerston, Ryegate, Hardwick, Woodbury and many other places granite of the best quality is found in immense quantities. The finest of iron crops out all the length of our mountains, but is not much worked at present; copper is mined at Vershire and gold in limited quantities may be found in the beds of many of our mountain streams.

## SCHOOLS.

In 1890 there were maintained in Vermont two thousand four hundred and fifty-two common schools, making the average distance from one school to another less than two miles. Colleges, academies, normal schools and high and graded schools are less than ten miles apart on an average through the State, all equipped with the best of houses, well finished and furnished. The supervision of these schools is in the hands of faithful and competent teachers and managers. Truly a grand and liberal educational system. It only lacks attendants, and perhaps a little permanence in matters of law.

## CHURCHES.

Nearly one thousand churches adorn the hills and valleys of the State, with a seating capacity fully equal to all who wish to attend divine service in houses made by men's hands. Those who do not, can find outside

"The perfect world by Adam trod,  
The first great temple, built by God."

## REFORMATORY INSTITUTIONS

like the State prison, jail, workhouse, reform school, insane asylum, etc., etc., are fully equal to the needs of the best police regulations, while our courts are famous for the justness, promptitude and accuracy of their decisions. On the whole, the State is well provided for with educational, moral, social and judicial machinery for the good care of a million people.

## VERMONTERS.

It is often truly said, "There is more in the MAN than there is in the LAND;" so in considering the desirability of Vermont as a place to live in, it is supremely necessary to consider THE PEOPLE OF VERMONT.

Who were they in the first settlement? Almost wholly of the Puritan or Pilgrim stock: almost all of English ancestry. They came up to these hills and valleys from Connecticut and Massachusetts and other of the older colonies to found a State on broader and even freer principles; they sought to separate the Church and State—to establish that then new doctrine, "That all men have a natural and inalienable right to worship Almighty God according to the dictates of their own consciences." Animated by a desire of personal liberty and social equality, they found among the grandeur of the hills, the beauty of the valleys, and the solemn quietness of the wilderness, a fit place to raise and develop *free men*. The early troubles with New York and other colonies about jurisdiction, rights of soil, etc., developed statesmen, the rugged and brave Ethan Allen, the patriotic and soldierly Seth Warner, the wise, thoughtful governor, Thomas Chittenden, and a host of like



men. And the breed of brave, patriotic, and wise has stayed with us from the days of Allen, Warner, and Chittenden to the days of Edmunds, Morrill, and Phelps. Of the forty-two men who have been governors of the State, who ever failed to serve her wisely and well?

And besides keeping the best always at home, what grand men has Vermont given to other States? To New York, President Arthur and Vice-President Morton, the great journalist—Greeley, the grand statesman—Silas Wright; to Pennsylvania, the Cromwell-like commoner, the man of the people—Thaddeus Stevens; to Illinois, “the little giant”—Stephen A. Douglass; to Wisconsin, Senators Carpenter and Vilas; to Iowa, a Kasson,—these and many other wise and notable men have gone out from Vermont. Yes, not only the noble, brave, and wise have gone, but the young, and strong, and beautiful. That is the great trouble with Vermont to-day, too many have gone out; that same uneasy spirit that led our Saxon-Dane-Norman progenitors eight centuries ago to go on the crusades, that led our later ancestors, the Pilgrims, out across the Atlantic to colonize New England, has led Vermonters to be always in the front of every movement to extend the area of freedom, or enlarge the borders of Christianity. Their’s has ever been

“ The tread of pioneers  
Of nations yet to be,  
The first low wash of waves where soon  
Shall roll a human sea.”

Foremost in war as in peace, they have fought for their country all the way from the Court House at Westminster, March 13, 1775, to Appomattox Court House, April 6, 1865.

“ Their bones are on the northern hill,  
And on the southern plain,  
By brook and river, lake and rill,  
And by the roaring main.”

And the result of all this going out of many and coming back of few is, that the State, instead of three million inhabitants that she has a right to call her children, had at the last counting, 1890, but three hundred and thirty-two thousand four hundred and twenty-two.

A few of those who went may have gained more of fortune or fame than they would to have stayed, but the great mass would doubtless have found more comfort and happiness and quite likely as much wealth, to have stayed in Vermont. However that may be as to the past, it is most certainly true of the present, that no State or country offers so many attractions and advantages at so little cost as can be found here. Nowhere in the wide world can you find so

#### CHEAP PRODUCTIVE LAND.

Besides the many unoccupied farms with comfortable buildings advertised in our pamphlet there are many fine pieces of land from which the buildings have been burned, removed or gone to decay, that can be bought for \$2 to \$5 per acre, that would with a small outlay make comfortable and happy homes. There are also many wide stretches of hill land, cleared at an early day, that would make the finest sheep or cattle ranches in the world, producing the sweetest of grass, abundance of water and located near good markets. And many of all these kinds of farms and lands can be bought not only cheap, but on easy terms of payment.

#### NO LACK OF CAPITAL.

For seventy years Vermont has been a money lending State ; there is no lack of capital here to-day, but rather a lack of the disposition to invest the wealth gained here in home improvements and enterprises. The money owned by Vermonters, to-day, if all called home and lent to promote home industries would in ten years build us all the railroads we need and put our highways and schools in the best condition ; would open the mines, quarries and mills of all sorts, and would no doubt develop new lines of profitable labor and it is more than probable that the capital would be full as safe as it is scattered all over the Union.

#### CONCLUSION.

Our conclusions, short and brief, are that

## VERMONT IS A GOOD STATE

to live in, and just as good as any to die in. It is worth something to have been one of the

## GREEN MOUNTAIN BOYS OR GIRLS.

Proud of her history, her present station and her future prospects, Vermont from her beautiful hills cries to her absent sons and daughters,

“ Come back to your mother, ye children, for shame !  
Who have wandered like truants, for riches or fame.  
With a smile on her face, and a sprig in her cap,  
She calls you to feast from her bountiful lap.”  
And to all honest strangers “ Come and welcome to  
The best land the sun shines on.”

WM. CHAPIN.

## VERMONT'S PROGRESS FOR 1891.

---

The Board of Agriculture having undertaken the work of advertising Vermont to some extent during the year 1891, the question often met has been, whether or not the State was advancing in its material interests. To get light on this point, toward the close of December, the following circular was mailed to each town clerk in the State :

1. Has any new industry been established in your town since Jan. 1, 1891 ? If so, (a) What is the character of the business?..  
(b) How much capital invested in it ? \$.....  
(c) How much help is employed ?.....
2. How many farms have been sold during the year ?.....
3. How many, if any, of these farms were previously unoccupied ?.....
4. Please give any additional information you can relative to the extension of industries already established, and of new ones in prospect.

In answer to these inquiries reports have been sent in from 220 towns. A full report would undoubtedly increase considerably some of the results found, as a few of the towns that it has been impossible to get reports from were among the largest in the State. The reports received show that 1,764 farms have been sold during the year ; of this number 252 were of the class known as unoccupied farms. In most cases, the purchasers of these unoccupied lands were persons who wanted them for homes. A good feeling is reported as prevailing among the farmers, and a slight increase in price of real estate is generally claimed. The sales made have been quite general throughout the State, the number sold in each County being : Windsor, 288 ; Orange, 218 ; Washington, 199 ; Windham, 168 ; Orleans, 159 ; Franklin, 130 ; Addison, 129 ; Cale-

donia, 125; Rutland, 93; Chittenden, 84; Lamoille, 67; Bennington, 56; Essex, 46; Grand Isle, 2.

The town of Barnard leads the list with a sale of 52 farms, of which 34 were of the unoccupied class. In many localities it is claimed that the purchasers of the farms are young men of the town; in other localities it is found to be young men who have for a little while tried farming in the new West and returned to find in Vermont what they had sought for elsewhere, the best place to secure a home and surround themselves and families with the greatest number of advantages at the least expense. The following extract from a letter from a man in Breckenridge, Minnesota, is a fair sample of many received within the past few months. It illustrates both the ignorance in regard to Vermont and the feeling for their own country. Under date of Feb. 3d, he says: "I want to learn about Vermont. Is it too cold to raise wheat, corn and beans? Is it very rocky and hilly? Is the land badly exhausted and run down? Please send me the pamphlet issued by your Board, as I would like to see what you have to offer. I don't like this miserable prairie country and want to get into a more attractive place." The fact that Vermont *can* raise wheat, corn and beans, as well as every other crop adapted to her latitude, and place her record in all at or very near the head, is coming to be understood, and the fact is bringing customers for all farming land that is for sale.

#### NEW MANUFACTURING.

The reports to the Board show that \$741,000 of capital has been invested in new manufacturing plants during the year 1891. This does not include the working capital required to conduct the business. There has also been quite a large investment of capital in extending manufactures already established that is not here included. The new plants were giving employment Jan. 1 to 2,197 persons. In view of the fact that since 1850 the census reports credit us with an increase of population of less than 20,000, the large increase the past year, which must come from employing this additional number of persons, makes a pleasant and striking contrast. These new industries have been scattered through the entire State and the range of products has covered a wide field. The

leading branch of manufacture has been in the line of wood products. The following towns have put in new plants under this head: Bristol, Panton, Lincoln, Arlington, Lyndon, Searsburgh, Burlington, Canaan, Guildhall, Lunenburg, Swanton, Westfield, Barton, Benson, Mendon, Clarendon, Chittenden, Fayston, Moretown, Marshfield, Waitsfield, Warren, Berkshire, Whitingham, Vernon, Stratton, Springfield, Bridgewater, Plymouth and Weston. These plants vary in capital invested and help employed from \$1,000 with one or two men to \$50,000 with 100 employes. The total investment in this line of manufacture is \$214,800 and 590 persons employed. Factories for the manufacture of shoes have been built at Burlington, Bethel, Royalton and Chelsea, representing an investment of \$136,000 and employing 425 persons. New granite quarries or shops have been started in Hardwick, Burlington, Montpelier and Calais, \$36,000 of capital invested and 210 persons employed; new slate works at Poultney and Fair Haven with an investment of \$78,000 and 155 workmen; new Marble Company at Swanton with \$20,000 capital; new creameries or cheese factories have been built at Bridport, Danville, Lyndon, Guildhall, Vershire, Thetford, Sharon, Barnard and Reading, representing \$25,000 invested.

Morristown has a \$50,000 tannery and a company for the manufacture of boot heels with \$30,000 capital; a button factory has been built at Stockbridge and \$8,000 invested; at Newport a factory for the manufacture of overalls and shirts with a capital of \$14,000.

Another feature of the year not coming within the line of either manufacture or agriculture, has been the building of several fine hotels intended, largely, to accommodate summer travel. Salisbury, Castleton, Woodstock and Chester have built during the past year and invested about \$200,000 in this way.

In the building up of new manufactures, Burlington takes the lead, and reports an investment of \$155,000 and 950 persons employed. All the manufactures that have been reported from the County of Chittenden came from Burlington. The several Counties of the State have invested capital and employed help in these various enterprises as follows :

	CAPITAL.	WORKMEN.
Chittenden.....	\$155,000,	950
Windsor.....	108,000,	277
Rutland.....	104,000,	211
Addison.....	90,000,	95
Lamoille.....	80,000,	80
Orange.....	39,000,	75
Washington.....	36,000,	90
Caledonia.....	30,000,	155
Windham.....	27,000,	94
Franklin.....	22,000,	42
Orleans.....	18,000,	58
Bennington.....	12,000,	35
Essex.....	9,500,	35
Grand Isle.....	<u>\$730,500</u>	<u>2197</u>

An inspection of the progress made in the past year may well raise a reasonable doubt as to the truth of the theory that has long prevailed, that Vermont could never be a manufacturing State. It is found generally that manufactures are built up wherever good opportunities are offered and encouragement is given. To secure manufactures it is first necessary to have some advantages and then let the fact be known.

The large increase in the business of the city of Burlington for the past year, as well as the large number of farms sold in the town of Barnard, goes to show the benefit derived from judicious advertising, and tends to the conclusion that it is a wise policy for towns or localities possessed of natural advantages or attractions, to let the outside world know what they have.

From the industries already established there comes generally a report of prosperity, and the many extensions made to their plants would indicate that they had reported correctly. Of the towns claiming a large increase of existing industries may be noted Barre and Dummerston, in the production of granite; Proctor, of marble; Pawlet, increase in slate quarrying; Morgan and Andover, increase in production of lumber; Thetford, large addition to their fish-rod factory; Randolph, increase of business at furniture fac-

tory ; Vershire, extension of copper mining ; Ryegate, increased production of brick ; Weybridge, wood pulp.

The information received points to a still greater progress for the year 1892 than in the year just closed. Several large enterprises are only awaiting the opening of spring. In this list we find the towns of Windsor, Dummerston, Montpelier, Tunbridge, Fairlee, Chelsea and Groton that expect to undertake new work in quarrying and working granite ; Bridport and Manchester are to work new marble quarries, Westminster is to have a paper mill, Ludlow a \$60,000 woolen factory, Dover expects to do an extensive business in mining iron ore, Springfield has in view a railroad and new hotel, Lemington has organized a Stock Company with \$250,000 capital to develop its mineral springs and build a hotel, and Burlington is expecting to secure several new enterprises.

The only new railroad construction that has come to our knowledge for 1891, is the extension of the Narrow Gauge road from Readsboro to Wilmington, thereby opening up the upper portion of the Deerfield Valley.

Though believing that the State was making progress, the Board did not suppose that as much had been, and was being done, to advance its best interests as the report shows. It has also been noted, in the institute work of the Board among the people that there has been very little discontent or dissatisfaction manifested, but rather, a hopeful, wide-awake, aggressive spirit, a disposition to make the most of opportunities at hand, which would indicate that the work of the past year was to be kept up and improved upon in the year to come.

#### VERMONT AS A FERTILE STATE.

Pending the publication of the statistics of agriculture in the census of 1890, the Brattleboro Phoenix prints the following summary of some of the facts found by comparing certain available statistics of this character :

1. Vermont leads 37 States in the average value of all farm productions to each person engaged in agriculture.
2. The value of all farm productions in Vermont averages



nearly \$400 to each person in the State engaged in agriculture, against a corresponding average of \$289 for the United States.

3. Vermont produces more than four times as much butter to each person engaged in agriculture as the average to each such person in the United States.

4. Vermont produces an average of 161 pounds more butter to each person engaged in agriculture than the highest average to each such person in any other State.

5. Vermont makes nearly twice as much butter per cow as the average per cow in the United States.

6. Vermont produces an average to each farm of 247 pounds more butter than the average to each farm in any other State.

7. Vermont produces an average to each farm of 510 pounds more butter than the average to each farm in the United States.

8. The average product of cheese to each farm is greater in Vermont than in any other State, excepting New York.

9. The average number of milch cows to a farm is greater in Vermont than in any other State.

10. The hay crop of Vermont averages more to each person engaged in agriculture than the hay crop of any other State.

11. The hay crop of Vermont averages more to each farm than the average to each farm in any other State.

12. Vermont has live stock averaging in value \$110 more to each person engaged in agriculture than the corresponding average value of live stock in the United States.

13. Vermont leads thirty-two States in the average value of live stock to a farm.

14. The average annual product of maple sugar to each farm in Vermont is nearly seven times as much as the average to each farm in New York. Nearly two-thirds of all the maple sugar produced in the United States is made in Vermont and New York.

15. In the yield of corn, potatoes and other crops per acre, Vermont generally stands at or near the head of the list of States. But two States had a larger yield of potatoes per acre, according to the annual crop report of the department of agriculture for 1890. For the same year the yield of wheat per acre was larger in

Vermont than in any other State east of the Mississippi. The yield of buckwheat per acre exceeded the yield per acre in Vermont in only one State. By the tenth census only two States had a larger yield of oats per acre than Vermont; only three States a larger yield of corn per acre, and the yield per acre of almost every crop cultivated in the State was far above the average per acre in the United States. Vermont has more than once stood at the head of the States in the yield of corn per acre.

16. The cost of purchased fertilizers used in the United States averages more than twice as much for each farm as the cost of purchased fertilizers for each farm in Vermont.

17. Vermont leads thirty-six States in the average value of forest products to each farm, not including maple sugar as one of these products, and not including the product of timber lands not belonging to farms.

Vermonters troubled with a tendency to heart failure on account of what they fear to be a general decline in the agricultural interests of the State should cut the above out and read it frequently. Such an exercise will serve as an excellent tonic.

#### CHEAP LANDS AND FINE BUSINESS OPPORTUNITIES.

In view of the foregoing facts taken from our census report, the question may naturally arise: Why has not Vermont increased in population? Why are these lands for sale at low prices? Why are not all business opportunities taken?

FIRST.—The people of Vermont are of that restless, uneasy, and ambitious disposition that has marked the pioneers of our country. Possessed of that desire to be in the lead in every new enterprise of civilization and settlement of new territory, they have given little thought to the advantages in their possession, but sought something new in untried fields, and the glowing accounts of the advantages of these new States have been accepted without question, while little or nothing has been said on the other side. The emigration to settle new territory is accountable for nearly all that Vermont lacks in the way of population. Another reason is found in the failure of Vermont to develop her manufacturing and mining industries and so employ more labor.

SECOND.—The cheap lands of Vermont are also due very largely to the fact that so many have gone that there are not enough people left to occupy all the land. It is also due to a change in the system of farming, and the adoption of newer and better methods. In former years large areas were desired, and men were judged in wealth by their acres. To-day, small farms, intensely cultivated, are desired, and the judgment is not by acreage, but by their products. This change has resulted in giving a large surplus of acreage and putting much land upon the market.

THIRD.—The fact that Vermont has many fine opportunities for manufacturing and mining is due largely to the fact that, until recently, but little interest has been given to these matters. The signal success which has attended the few manufacturers which have located among us, has directed attention in this direction, and the past year has witnessed rapid development. A further reason for neglecting these home industries is found in the very great interest taken by Vermonters in the building up of similar enterprises in distant localities, where they have been promised large dividends from their investments. This has made capital for home development scarce and prevented much progress. The collapse of several of the enterprises where Vermont capital was largely invested has had the effect of raising a doubt as to the advantage of foreign as against home investments, and to-day capital is readily found in any of our enterprising towns to forward any new enterprise that gives reasonable promise of success. It is believed that as the attention of our people is now largely directed to their own State, many avenues as yet untried, will be found in which labor and capital will find safe and profitable employment.

#### SOCIAL, EDUCATIONAL AND RELIGIOUS PRIVILEGES.

To a Vermonter, no society is as good as that of Vermonters. This has, perhaps, led the State to be a little exclusive, and the result is that no State has so large a proportion of its population native born as Vermont. At the same time, all nationalities are cordially welcomed, if they come with the intent of becoming industrious and law-abiding citizens. From the earliest settlement of the State great interest has been taken in matters of education, and

there are few farms in the State but that have the privilege of a school at a distance of not over a mile. Nearly all the larger villages are provided with graded schools or academies, in which the student is fitted for a college course if desired.

The greatest freedom of religious worship prevails, and the church spire is found in every hamlet, and usually two or more of the denominations in every village of any considerable size.

#### LABOR.

While the State offers good opportunities for the investment of capital in its land, or in establishing or developing any of its varied industries, there is also a good opportunity for persons without capital, except a willingness and ability to labor. On the farm, at the quarry, in the mill or shop, is nearly always a demand for additional help, and at prices which are sufficient for support and a surplus to lay by for the future; and perhaps in no department of labor is the demand so far in excess of the supply as in that of domestic help for the household. Thousands of capable women could here find employment among a people who make their employes a part of their own families, and repay competent assistance with liberal wages.

#### PEOPLE.

The people of a locality are always an important consideration in the minds of persons who are to come to live among them. Vermonters are peculiar in many ways, but in nothing is their disposition more marked than in their intense love of liberty and equal rights, of liberty of thought and action, so long as it does not infringe upon the rights of another. In defence of this principal, the history of the State and the nation has occasion to record on many of its pages the deeds of courage and valor that have been necessary to maintain it. As believers in equal rights, the proof is found in the absence of anything akin to aristocracy. The lowest and the highest, the rich and the poor, meet on equal terms in all the walks of life, neither realizing that any gulf is between them. No people have a higher respect for law and good citizenship than

Vermonters, and no people will more strenuously insist on the punishment of offenders. They have great respect for moral or intellectual superiority, and would be considered as somewhat Puritanic in their views and tendencies, and rightfully so, as having, in the main, descended from that honored stock. No people have a prouder record in the past, and none can go before them in the essentials of good citizenship in the present.

## GENERAL DESCRIPTION BY COUNTIES.

---

### ADDISON COUNTY.

This is often called the Garden county of Vermont. Most of the surface is comparatively level. Only the eastern part is mountainous. The county borders on Lake Champlain, and the border towns and nearly all the western part of the county has a very rich natural soil. Clay predominates. It is noted for its very productive pastures, and large crops of hay of a superior quality.

The land in the eastern part of the county is rough and hilly, but productive, and lumbering is carried on to a considerable extent.

### RIVERS.

Otter Creek passes through the county, emptying into the lake at Ferrisburgh. It is navigable as far as Vergennes, and small steamers ply between that city to ports on the lake. Dead Creek, Lemon Fair, and the New Haven River are tributaries to Otter Creek, and are from 15 to 25 miles long. Otter Creek furnishes valuable water power at Middlebury and Vergennes, where are located several large manufacturing establishments of various kinds.

This county is particularly noted for its improved stock of all kinds, but more especially for its sheep and horses. The Merino sheep reaches its highest state of perfection here. Addison county sustains the enviable reputation of producing the best Merino sheep in the world. Sheep for breeding purposes are shipped to all the wool growing countries of the world and bring remunerative, and in not a few instances, fabulous prices. The rich pastures and hay, together with the management and care of the skillful breeder, will always make this country a center of attraction to those looking after the highest type of the Merino.

### HORSES.

While the Morgan horse is one of the productions that the State is justly proud of, and every town and hamlet boasts of some

of more or less notoriety, Addison County can boast of some which have a national reputation. This County was the home of Hill's Vermont Black Hawk, Daniel Lambert, Ben Franklin, Delong's Ethan, and scores of others that have proved valuable. Descendants of some of these noble animals can be found on nearly every farm in the County; the breeding of the typical Morgan is one of the leading industries, and is being pursued by some of the most intelligent men in the County, who spare no pains in their ambition to produce a perfect type of this noble animal.

The areas of interval, or flowed lands, of the Otter Creek and some of its tributaries are very extensive, and a large per cent of it is still undeveloped, much of it covered with wood, and a large amount covered with stumps. With a proper system of drainage the agricultural products of the County could be more than doubled. It already ships a large amount of hay to market every year, and might double the amount were their resources all utilized.

There are large deposits of marble and limestone in the County, and the latter is being extensively quarried and burnt at Leicester Junction.

Among the institutions of learning may be mentioned Middlebury College at Middlebury, Beaman Academy at New Haven, and fine graded schools in all the large towns.

At Bristol there is the largest burial casket manufactory in New England, new marble mill at Belden's Falls, and pulp mill below Middlebury at Otter Creek. The timber for this mill is floated down the river from towns above. Middlebury is the County seat, and is a thriving town. Its new County court house and other public buildings speak well for the thrift and intelligence of the people. Vergennes, an incorporated city, is largely engaged in the manufacture of horse nails, curtain rollers, doors, sash, blinds, and furniture. The State Reform School is located there.

#### BENNINGTON COUNTY.

Located at the extreme south end of the State, and at a slight elevation above the Hudson River valley, this County has a climate and soil that is all that could be desired. The Hoosac and Walloomsac valleys in the south-west portion of the County have a

wonderfully rich and productive soil. Situated on the Fitchburg railroad and so near the large manufacturing towns and cities of Massachusetts, also Troy, Albany and New York, these lands have a high value for agricultural purposes. The towns bordering on Massachusetts—Readsboro, Stamford and Pownal—have exceptional advantages of a good home market for all their farm products in the large and rapidly growing town of North Adams, with its 16,000 inhabitants. The milk man and the dairyman here are able to report a yearly income of from eighty to one hundred dollars per cow. Market gardening is quite extensive and profitable. The western, central and northern sections are well adapted to agriculture, having a quick and responsive soil. Rupert, bordering on New York, and located on the D. and H. C. R. R. ranks high as a farming town, while the other towns on the line of the Bennington and Rutland R. R. have excellent facilities for shipping to market such products as are not sold at home, the large towns upon the line of the railroad making a good home market.

Dairying is a leading branch of farming, and there are good cheese factories at Dorset and co-operative creameries at Rupert and Bennington, the excellence of their products securing a ready sale.

Sheep husbandry is receiving attention and promises to become quite general, there being a ready market for early lambs and mutton. The farmers of this County, like the farmers of Vermont generally, are giving more attention to raising those horses that are sought after in all the markets, Vermont Morgans, so noted for their powers of endurance and staying qualities. It is acknowledged that the horses of prime value in every section of the country trace back from either sire or dam to the Green Mountain State.

Being well supplied with railroads, the County has large manufacturing industries. Immense quarries of fine marble are extensively worked at Manchester and Dorset. All the principal towns on the line of railroad have their various factories, while Bennington on the Lebanon Springs and Bennington and Rutland railroads, connecting also with the Fitchburg, and with good water



power, has extensive mills of various industries, giving the town a population of about 7,000.

Readsboro, on the Deerfield Valley railroad, is developing large manufacturing industries. The Pulp and Metal Edge Box Co., a large chair factory, an extensive tannery, a paper mill in process of building, and other mills in prospect, give life and animation to the surrounding towns.

One of Vermont's famous men said : " Vermont is the Switzerland of America ;" and Bennington County may well claim her full share of this grand and beautiful scenery. Along the eastern boundary from north to south, and extending the entire length of the County, stands an unbroken range of the Green Mountains, which is always a delight to the eye and an inspiration to the soul, while across the valley and opposite at Manchester and Bennington stand Mount Equinox and Mount Anthony, towering above the surrounding hills and accessible to their very tops by carriage roads. These, with the Taconic range along the New York border and western Massachusetts, including old Gray Lock, 3,500 feet high, constitute magnificent natural surroundings. This scenery, together with the pure and health-giving air, the sweet and never failing waters, the high moral sense and public spiritedness of the people, has made this County a desirable summer resort for people of culture and refinement. Every hamlet has its guests, the summer hotels are crowded, and some are buying farms for permanent summer homes.

#### CALEDONIA COUNTY.

Caledonia County was organized November 8, 1796, with Danville as its shire town. It was called Caledonia in honor of the numerous emigrants from Scotland, Caledonia being the ancient Roman name of Scotland.

The soil is good, and suited to every condition of agriculture. The western portion of the County is mountainous, and although the farms in that part are on high lands, they admit of successful cultivation, some of the best farms in the County being on the high hills of Danville. The valleys of the Connecticut and Passumpsic Rivers are composed of rich, deep soil, and are easily cultivated.

It has been said of Caledonia County that every farm has its own muck bed. While this is not strictly true, yet the deposits are so abundant that every farmer can avail himself of this most excellent absorbent at little or no expense. Caledonia County is a rich farming district, and scores of farms give an affirmative answer to the question "Does farming pay?" The farmers are rapidly adopting the modern methods of agriculture, realizing that the old ways of fifty years ago are as much out of place on the farm as in the store or shop.

The County is well watered by many streams. The Connecticut runs along the southeastern side, and the northern towns are watered by the head waters of the Passumpsic. Every farm house can be supplied with pure soft running water from the numerous springs which abound. There are many falls at numerous places on the rivers, with power both improved and undeveloped, which should make the County one of the first for manufactures. Among them are Stevens River, which falls eighty feet in the distance of twenty rods near its mouth; the Emerson falls on Sleeper's River, half a mile from St. Johnsbury, which falls seventy-five feet in five rods; an available power at Passumpsic of from 300 to 500 horse power, with two side tracks; a 500 horse power of the St. Johnsbury Power Co., of which less than a third is used, the Great Falls at Lyndon, owned and formerly used by the Widder Pulp Co., an immense power which is now idle; and many others.

The mineral resources are principally of granite. In Kirby and Sheffield are extensive deposits of granite of very good quality and texture, which have as yet been worked but little. The Blue Mountain granite from Ryegate is known the country over, and is considered the best for monumental purposes of any in the State.

Gold specimens have been found in Waterford, and the rocks there are of a gold bearing formation.

There is also a slate ledge in Waterford, from which roofing slates of very good quality have been quarried, but which is not worked at present.

The transportation facilities are excellent, three different lines of railways crossing the County. One runs the entire length, north and south, and the others east and west, giving direct lines

to Portland, Boston, and Montreal, with but six hours' ride from either of the three. St. Johnsbury, at the junction of two of these roads, offers exceptional advantages as a business point, and also as a place to live. The town is liberally disposed toward legitimate manufacturing enterprises, and the formation of an energetic Board of Trade has awakened new interest in the resources of the town as a manufacturing center.

Any information as to water power, purchaseable farms, or anything of interest to a would be purchaser, will be furnished upon application to the Selectmen of the town, or to the St. Johnsbury Board of Trade.

Caledonia joins with her sister Counties in presenting fertile plains, well watered valleys, health-giving breezes, and never-failing harvests, as inducements to Vermont's sons in the West to come home to the mother State, which has enough and to spare for their comfort and sustenance.

#### CHITTENDEN COUNTY.

Chittenden County, which received its name from Vermont's first Governor, Thomas Chittenden, lies a little north of the center of the State, and borders on the State of New York, a portion of the beautiful waters of Lake Champlain being within its limits. Its average length from north to south is about 26 miles, and from east to west about 23 miles, and contains about 520 square miles. It is divided into 15 towns and the city of Burlington, and has a population of about 33,000. The first range of townships lying upon the borders of Lake Champlain are pleasantly diversified with hills, valleys and ravines, but there are no elevations of any considerable height. The western boundaries of these towns are quite irregular, arising from the various points extending into the Lake, and the numerous bays running inland which furnish very pleasant fishing grounds for those who delight in such sport. Upon these points and upon the shores of the various bays are many beautiful groves, among which are several summer camping grounds, with numerous cozy cottages tastefully arranged, making lovely villages—a beautiful place for retirement and recreation and yet of easy access from business places.

The next range of towns is more elevated and undulating, while near the eastern boundary of the County we find the foot hills of the Green Mountains, and at its eastern extremity tower up to the highest peaks of these Mountains. The scenery in this County is truly magnificent. The Green Mountains in the east extending north and south as far as the eye can see, with the famed Adirondacks surrounded by a crowd of hills lying in full view of the west, furnishes a scene so varied and delightful that the eye never tires with the view, continually discovering something new and gratifying to the beholder.

A great variety of soil can be found here, a great share of which is very productive, as is witnessed by the ample crops raised in various parts of the County. The light, sandy soil, though not desirable for grass, is quite remunerative when used for market gardening. A good deal of the soil is of a sandy or gravelly loam and excellent for cultivation and producing good crops of hay, and there is also quite a little clay and loam, and some nearly all clay, both of which are strong soils, bringing paying crops. This County also has its full share of alluvial soils upon the various rivers and large streams intersecting it through the different towns. Unless it be Grand Isle County, there is no place in the Champlain Valley so renowned as a fruit growing region. Especially is this true of the lake towns, where all kinds of fruits adapted to this latitude are raised in abundance.

There is a ledge of the red sand stone extending nearly the whole length of the County, cropping out at various points, which is valuable as building stone. Near the center of the County lime rock is found in great abundance, also running the whole length of the County from north to south. At Mallet's Bay there is marble variegated with various colors, which takes a fine polish, and is excellent for ornamental purposes, while in Shelburne and Hinesburgh samples of white and variegated marble have been taken out which are equal to that from any quarries in the State, and it only needs energy and capital to develop quarries furnishing marble of excellent quality.

Much might be said of the forest productions, but suffice it to state that all the varieties grown in the northern part of New Eng-

land flourish here, among which is a large supply of the sugar maple, making many valuable sugar orchards and yielding a good revenue.

There are many good water powers on the various rivers and streams running through the different towns, some undeveloped and but few fully utilized. These afford inviting opportunities for nearly all kinds of manufactures.

The railroad facilities in this County are excellent. The different roads intersect each other near the center, affording excellent shipping privileges, and rendering the different localities easily accessible.

There are in the County, besides the common schools, several graded schools, affording fine opportunities for education; also quite a number of high schools of excellent reputation. Burlington is the seat of the Vermont University and State Agricultural and Mechanical College, having in connection with it a medical department, supplied by able and popular professors. Here, also, the Rock Point Institute is located. This is a school of the highest order.

Burlington, the "queen city" of Vermont, offers inducements to people of various tastes and of all vocations equal to those of any city in New England. If it be the tourist seeking beautiful scenery, no more picturesque views can be found anywhere than those from College Hill. The country stretching to the north and the south till it meets the horizon, and dotted with cottages, green fields, woods, and villages, bounded upon the east by the Green Mountain range, and on the west by the charming Adirondacks, with the beautiful waters of Lake Champlain lying between, makes a scene at once both charming and delightful.

To a man seeking for a quiet and pleasant home no more beautiful and charming place can be found, and when there is added to this its Church privileges, its educational facilities and its public library, it holds out attractions equaled by few cities. To a man seeking to engage in trade or manufacturing, excellent inducements can be offered. This is the center of trade for a large part of the State and a large portion of the Adirondack region. As a place for engaging in manufacturing of any kind it has great ad-

vantages, as the railroads from the city lead in all directions. And to this may be added the cheap water freights which may be obtained on the lake to the north into the Queen's domains, and to the south and various points in the west. All these combined make its shipping facilities, which are one of the essential requisites in manufacturing, all that could be desired.

#### ESSEX COUNTY.

This county occupies the northeastern corner of the State, bordering on the Connecticut river for about sixty-five miles, reckoning all the turnings and windings of that stream, although by direct measure the County is but forty-five miles in extent from north to south, and twenty-three miles from east to west. Agriculturally Essex may be, as it has often been called, the poorest County of the State ; but it has some advantages that no other County equals. In the value of its timber and unculled wood lands, in the picturesque beauty of its natural scenery, in its fine hunting and fishing grounds, in its excellent railroad accommodations, Essex County is ahead of many of the other Counties. Then there is a splendid belt of farming land along the bank of the Connecticut, most of the way from Concord to Canaan, and also some fine farming sections inland. The broken hills of the interior furnish much good pasture for cattle, sheep and horses. Aside from the grass, which is the principal farm product, corn, rye, oats, peas, beans, potatoes and maple sugar are the leading products. Some of the best maple sugar orchards in the State are in this section. The high elevation of the land seems to be favorable for making the nicest quality of sugar found in the market.

Some of the principal villages in the County are about one thousand feet above sea level, to wit: Island Pond, 1,250 feet ; Lunenburg Corners, 1,144 ; Concord Corners, 1,095 ; Guildhall Falls, 893 ; mouth of the Nulhegan, 962 feet. This elevation, with vast acres covered with resinous woods, like pine, spruce and balsam, plenty of pure air from the mountains and water from the springs—these and many other life preserving aids make this one of the healthiest spots on earth. Grave yards are scarce and no asylums or health resorts are needed. Game of many kinds still

roam through the vast primeval forest of northern Essex, from the gigantic moose, the graceful deer, the sturdy bear and the noxious wolf, down to the timid rabbit, the alert weazel and the curious bat. The last moose killed here, so far as known, undertook a race with a railroad train on the Grand Trunk at Brighton, in 1858. He kept ahead for a mile, but in turning to look at his foe was struck by the second car and killed, throwing two cars from the track. Fish of the most valuable varieties, such as lunge, trout, pickerel, perch, etc., are abundant in the numerous lakes, ponds, rivers and brooks. In fact this is one of the favorite resorts of the hunter and fisherman, whether he seeks for pleasure or profit.

But the lumberman does not always admire the sportsman. We give an extract from a leading lumberman, to show how they feel about the hunters, the railroads and small farmers, reminding the reader that there are two sides to most controversies :

“Northern Essex county has very few abandoned farms, because she has few to abandon. And it would have been just as well if there had been still less. To be sure there is land in the valley of the Connecticut and along the banks of its branches that admit of cultivation, but the larger part of the land is too rocky, too broken. The soil is too poor to be worth clearing. It ought to have been kept in the line provided by nature, the growing of timber, the cutting of which is a subject that will repay careful consideration, and ought to be a matter for enlightened legislation. If the forests of this country had been properly handled in the last forty years, that is, only mature timber cut, the small growth saved, and the fire kept out, there would have been nearly as much timber here now as then, and the land instead of being worth from one to three dollars per acre, would be worth from ten to twenty. The practice has been indiscriminate slaughter. This has left the timber an easy prey to the fire, which has proved to be a greater enemy to the forests than the axe. The principal causes of fire are first, railroad trains ; second, new settlers ; third, hunters and sportsmen, a class of men for whom I have little love or respect. The railroad fires have been most destructive in this County, having burned over thousands

of acres. In very few instances have the railroad companies paid any damages. They will not pay unless forced to do so, and few men have the courage or means to compel them to pay. After the fire has gone over the land once, it is likely to run again and again, as no care is taken to prevent it. I have in mind a lot of land from which the timber was cut thirty-five years ago. The next year a fire went over it. It came up to red cherry and poplar as is invariably the case here. Last year the poplar was cut and sold for pulp making, leaving a good growth of small pines, spruce, hemlock and birch, showing what nature will do when left to herself. I call to mind another lot of land from which the mature timber, both hard and soft, was properly cut twenty-five years ago. The fire was kept out. Last year it was cut again, and fully eight thousand feet of good spruce lumber was cut to the acre. In twenty-five years more a similar crop can be cut. The practice has been for lumbermen to sell lots to settlers at from two to four dollars per acre, usually on time, or for very little cash down. Then begins the clearing. The settler's fires frequently run beyond his lot, and often burn more in value of the lumberman's standing timber than the lot was sold for. As a rule, these settlers have not succeeded. After three, five, sometimes ten years, with small crops, hard work and poor fare, they have abandoned their places to the men holding the mortgage, which is often largely swollen by store bills. I have a case in point. A man bought one hundred and fifty acres of land within one mile of the railroad. The large spruce timber had been cut; there was left of small timber and other growth, twenty to thirty cords of wood to the acre; this wood was worth three dollars per cord on the railroad line. This man worked hard for ten years to cut this wood; he cleared one hundred and twenty-five acres, built poor buildings, and then turned it over on a mortgage, owing seventeen hundred dollars. An adjoining lot of one hundred and fifty acres was similarly situated. The owner contracted the cutting and drawing of the wood to the railroad, realizing over twelve hundred dollars from the stumpage. This he did not fool away in clearing the land. The settler's fire ran over the other lot. Both lots are now in the same pasture, but the lot that was not cleared is the best. All good woodchop-



pers are not good farmers, and this is one of the difficulties. A man who can do nothing else thinks he must have a farm.

But to the third source of fire, the hunters and fishermen. They are usually a lawless, careless set. I have often seen traces of them in the unbroken forests, oftener about the streams and logging camps. They set fires and leave them without care. Many a lumberman has lost a good set of camps from this cause, but the loss of the camps was trifling compared to the loss by fire in the forest. Some times they camp on the border nearer to civilization to plunder. I have a case in point. I once had a cosset sheep that ran with the cows. She had a very fine lamb. Early in September the lamb was missing. One day I met a hunter whose camp was just outside my border and substantially the following conversation ensued: "You have lost your lamb I hear." "Yes, he seems to be missing." "Well, a bear has got him. I have been up to Megantic. When I came back to my shanty last week I found there had been a bear in it. I tracked him out and found where he had dunged and I took a stick and pawed over the dung and there was wool in it." These are some of the things that we do not want; neither do we want "assisted Swedes" to attempt to clear our forests and starve in doing it, or walk away seventy miles to avoid starving, as the papers say they have done from Norton. What we do want is men of brains, with money; men to take the mills already built and to build new ones to manufacture our millions of hard wood into every thing that is made of wood, from a tooth pick to a polished chamber set; men and capital to do this, while another growth of spruce, pine and hemlock matures; facilities to manufacture all this hard wood to a finished product and ship to the consumer, instead of cutting as heretofore. As now generally managed, only selected trees are cut. Half the tree is left in the woods. The butt is sawed into boards, and shipped to Massachusetts. Thirty-three per cent of its value is paid for freight and as much more on the manufactured product returned.

If such manufactories as are common in Massachusetts, could be put into the State of Vermont and encouraged by the State, they would enable its villages not only to hold their own, but to

be built up. And I hold that a Vermont village furnishing to the men, the boys and the girls remunerative employment, has more possibilities for comfort, for culture, for Christianity, for social enjoyment, for real happiness, than any other spot on earth.

Something must be done for the farmer, for the native Vermonter who has stuck to the soil, even though his mortgage, rather than his bank deposit, has grown. The State can get all the money she needs at four per cent. She should make it possible by legislation for the farmer to do the same. It could be done by exempting from taxation all money on farm mortgages loaned at four per cent. It would also help, since the mortgage is taxed, to exempt from the list all real estate, as well as personal property, to the full amount of the mortgage."

S. D. HOBSON,

EAST BRIGHTON, VT.

The lumber interest is no doubt the great money interest of the County at the present time. How long this will continue can not accurately be computed, but one thing is certain: The beautiful, winding Connecticut will always pour its crystal flood along the eastern border; the grand presidential peaks of the White Mountains will always loom up over to the east in full view from every hill in the County; the solemn stillness of the woods and the sweet music of waterfalls will remain, and bye and bye, as the cities and the country fill up, people will want to see this glorious scenery, this panorama of nature. The present and future inhabitants of Essex County can hardly afford to ignore or to neglect their great opportunities as a place of summer resort; nor can they afford to give up to wilderness again the farms that are fit for cultivation. Some of the poorer lands may well be left to grow up again to timber, and the remainder be more intensely worked. Markets are near and freights are lower to those markets from Essex County than from many other parts of the State. On the whole, we think that the blessings of God's Providence are pretty fairly distributed through Vermont by Counties, and that Essex is neither last nor least.

## FRANKLIN COUNTY.

Franklin County extends south from Canada line along the shore of Lake Champlain 33 miles, and east from the lake to the Green Mountains 34 miles, and contains 600 square miles of territory. It has a population of 30,000.

Its surface is varied, somewhat hilly, yet without much waste land. The largest bodies of water are Franklin and Fairfield ponds, and principal rivers, the Missisquoi and Lamoille. The natural scenery is abundant, varied and picturesque.

The soil is generally good and productive. In some sections there is a considerable admixture of sand, in others of clay, but usually there is more of a gravelly character, with hard pan below.

The geological formation is similar to that of the rest of the State. In the western part lime-stone abounds, and in Swanton, a large quantity of lime is manufactured. Slate and granite are found to some extent, and along the lake shore a kind of red limestone or marble which has been quite largely used for building purposes. Within the past few years the Geo. Barney Marble Co. of Swanton has been developing a quarry of mottled—red and white—marble in that town, which is capable of fine finish and is useful for ornamental work.

Generally, away from the rivers with their fine intervale meadows, the farms are more or less stony, but composed of good land. As an agricultural section Franklin County is probably second to no other part of the State. The soil is adapted to all kinds of crops grown in this part of the country.

## PRODUCTIONS.

Along the Champlain Valley the finer varieties of fruit can be successfully produced, while back towards the mountains the more hardy kinds have to be substituted.

As stock is largely kept, hay is a leading production. Potatoes and the various kinds of grains are raised to a greater or less extent, but these products are mostly made use of at home. Some hay and potatoes are sent away, but more than the value of these in flour and in feed for stock is returned.

Dairying is the leading industry of the farmers. Formerly, especially in the western part of the County, Merino sheep were kept in quite large numbers, but they are now mostly displaced by other kinds of stock. I think the interest in sheep husbandry is reviving somewhat, and there is no doubt but that more of the best breeds might be kept to good advantage.

In 1880 there were in this County 6,099 horses, 669 oxen, 29,426 milch cows, 14,513 other cattle, 12,699 sheep, and 7,730 swine. The production of butter amounted to 4,066,249 pounds, and cheese to 24,971 pounds. It is probable there are more horses now than in 1880, less oxen, possibly not as many sheep, and as many or more cows and swine. There ought also to be more butter and cheese produced and more horses raised, as increased attention is now being given to this kind of stock, with a manifest improvement as the result. The dairy stock is also being materially improved by the introduction of superior butter-producing breeds. The production of cheese is being considerably increased, principally by the factory system, of which there are several in operation. A limited amount only is now made at the farm. The introduction of cream separators into this County has made quite a change in the methods of butter-making. Previous to 1891, there were 25 or more separators located at different points, and ten or twelve creameries where the butter was made. In the autumn of 1890 the Franklin County Creamery Association was organized. This includes all but one creamery in the County. Separators are located at the most eligible points, where the farmers deliver their milk, and the cream, after being separated, is taken to St. Albans and made into butter on the most approved plan. There are at present 50 separators running in the interest of this association in the County, receiving the milk from some 600 dairies. From 7,000 to 8,000 pounds of butter a day are made from this milk. This is the only enterprise of the kind in this part of the country, there being but one other in the United States—in the State of Iowa.

There is a large amount of butter still made upon the farm, and many fine dairies bear an excellent reputation in the markets.

---

**RAILROADS, HOTELS, ETC.**

Railroads running through the County in various directions furnish excellent transportation facilities. There is a considerable number of villages, several of which from their favorable location are increasing in size and importance from year to year. Among these may be mentioned Richford, Enosburgh Falls, Swanton and St. Albans. Good country stores and hotels are found in most of these villages. Franklin County is becoming more favorably known and appreciated every year as a pleasant and healthful summer resort.

The summer hotels at Sheldon Springs, Highgate Springs, and on St. Albans Point and Maquam Bay, are favorite retreats for health and pleasure seekers. The shores of Lake Champlain are also being largely used for camping purposes, and the outlying villages are coming in for a share of summer boarders.

**MANUFACTURES.**

The County has a pretty good representation in this line, but still there is room for much more. Montgomery may be considered the banner town of the County for the manufacture of butter tubs. Richford has extensive lumber mills and manufactories for butter trays and boxes, Enosburgh Falls is known far and wide for the variety and amount of patent medicines manufactured, Highgate is well known for its edge-tool factory and foundry work, Swanton for its lime and marble works and several important manufactories, and St. Albans for a large variety of industries too numerous to mention here.

There are excellent opportunities for engaging in industrial pursuits. Good water privileges may be found on the Missisquoi river in the seventy-five miles of its devious course through the County ; also on the Lamoille river, with a fair quantity of timber for manufacturing purposes. The right kind of men with sufficient capital is what is most wanted to utilize and develop these long neglected privileges and turn them to good account in desirable manufacturing enterprises.

## EDUCATIONAL, RELIGIOUS, ETC.

The County is well supplied with educational advantages. Aside from the district schools which usually are well maintained, several of the towns have graded schools with higher departments conducted on a liberal plan. The academical schools of Swanton, Fairfax, Bakersfield and St. Albans are ably conducted and liberally patronized.

Perhaps no other part of the State is better supplied with religious advantages. Every village and hamlet almost has one or more churches, and the different evangelical denominations are well represented.

There are one daily and five weekly newspapers, and a live agricultural society that has been in existence for over twenty-five years. I know of no so-called abandoned farms in the County. Occasionally farms are advertised for sale, and it is probable that purchases could be made at fair rates, if desired, by those seeking homes in a prosperous and intelligent community.

## GRAND ISLE COUNTY.

This County is situated in the extreme north-west corner of the State of Vermont, and with the exception of the north line of the town of Alburgh, it is entirely surrounded by the waters of Lake Champlain. It consists of five towns, viz: Alburgh on a point setting into the Lake from the north, with a population in 1890 of 1,614; Isle La Motte on an Island south-west of Alburgh, population 504; North Hero, south-east of Alburgh, consists of one large island and several smaller ones, with a population of 637; Grand Isle, next south, occupies the northern half of the island of Grand Isle, with several adjacent smaller islands, with a population of 746; South Hero occupies the south half of Grand Isle, with some small islands, and has a population of 620.

The surface of the County is generally rolling, with no mountains, no large streams, and few swamps.

The basis of the soil is Champlain clay, modified somewhat in places by drift and the decomposition of the underlying rock,

which, with the exception of Isle La Motte and a small part of the west shore of Grand Isle, is Utica slate. In the exceptions named the rock is Chazy, and Trenton lime-stone. The clay soil prevails over a large portion of the north part of the County, and is nearly level, free from stone, and is excellent for grass, wheat, oats, etc., and when properly underdrained, produces good crops of corn, beans, etc. On the slaty hills and ridges, and the more hilly portions where the clay is more or less mixed with the drift, the soil is excellent for fruit, potatoes, peas, beans, clover, and all garden crops. The adaptability of the soil of Grand Isle County for various farm products, may be shown by the following facts. From the first settlement down to about 1835 the principal money crop was wheat, large crops of both winter and spring varieties being raised. From that date to about 1865, the main reliance for money was Merino sheep and wool; nearly every farm was stocked to its full capacity with sheep, and they were remarkably vigorous and healthy. This County was never visited by the diseases which proved so destructive to flocks in other parts of the country. At present the industries of the people are more diversified than at any previous time. Hay is largely sold from farms well adapted to that product; oats, beans, potatoes, and onions are staple crops on a majority of farms, and many are engaged in dairying with good success. The production of fruit, especially of winter varieties of apples, is attracting considerable attention, and it will soon, if it does not now, stand at the head of our money crops. Within a few years several large farms in various parts of the County have been devoted mainly to the raising of fine horses with a fair prospect of success.

The first settlers of Grand Isle County were mainly from the older New England colonies, of English stock, and they made their first settlement about the year 1783. Later there has been a considerable influx of Canadians, and there are a few of other nationalities among the inhabitants.

There are no mines, factories or manufactories of any extent. Each town has a small village or "corners," where the churches, post-office, store, and various shops are located.

Within a few years the attractions of our beautiful lake have become known to pleasure seekers from other States as well as our

own, and each year brings more and more of them here to spend a few weeks in summer, enjoy the good fishing and cool bracing air. Many have bought a choice bit of shore, or a point or a tiny island and built thereon their summer cottages, more or less costly and elaborate as their means or fancy dictates. They are gladly welcomed by the people. Even sometimes the thrifty islanders make the ministering to the wants of the strangers their best paying crop.

This is sometimes called the "County of Bridges." Besides the two long bridges of the Central Vermont R. R. which connect Alburgh with the main land on the east and west, there are three fine draw bridges across arms of the Lake, from Isle La Motte to Alburgh, Alburgh to North Hero, and from North Hero to Grand Isle, each nearly one-half mile long, and built at the joint expense of the State and the towns. South Hero is connected with the main land by the sand bar bridge, a causeway nearly three miles long, and another fine single span iron bridge crossing the Lamoille river at its mouth, the cost of which was borne mainly by the towns of South Hero and Grand Isle, completing the system of bridges and connecting us together, and with the main land.

A drive through the Islands over fine roads and through a fine farming region almost constantly in sight of the lake or some of the numerous inlets or bays, with good hotels at convenient points, will soon be one of the attractions of Grand Isle County.

#### LAMOILLE COUNTY.

Lamoille County is small geographically, but the average Lamoille County man who has long had his home within her limits, and knows something of her history and resources, feels that she is about the largest County *of her size* in the State.

"The Switzerland of America" has not a spot in all her borders where beauty of scenery, of hill and valley, mountain and river, is more diversified or pronounced, or where more cubic yards of pure bracing mountain air may be found than in the little County that nestles among the foothills of Sterling and Mansfield. Every town in the County has, to a great or less extent, furnished a temporary home during the summer months to people from the



cities and the more populous centers, who come seeking recreation and rest from the wear and worry of business, and that health which our pure air, pure water, and wholesome fare imparts. The town of Stowe, especially, has for many years been a popular resort. The town is situated at the base of Mount Mansfield, on whose summit, the highest point in Vermont, is Mount Mansfield Hotel, which is open to guests each summer. The town is rich in its farming lands, and its farming population is prosperous—a condition of things which may be due in some measure to the fact that during the summer season the town is invaded by a foreign population, furnishing a home market for their products.

What is true of Stowe is true in some measure of the rest of the County. We have little waste land and no deserted farms, and our farmers are not looking for a chance to give away their farms. The honest farmer who has attended strictly to his vocation, and has not embarrassed himself by outside speculation, will tell you that here and now farming pays. No more productive or better equipped farms, and no more prosperous farmers are to be found anywhere than are found on either bank of the Lamoille river and its tributaries. From Hardwick to Fairfax line nearly all of our interval farms are under a high state cultivation, and yield abundant harvests of all our standard crops. Little or no Western corn is bought by men occupying these farms. They raise not only their own supply, but have a surplus for their neighbors.

Cambridge is one of the wealthiest towns per capita in the State, and yet it is distinctively a farming town. Very little other business is carried on. As a rule the farmers own their farms and till them on scientific principles, using improved machinery and the best appliances.

Fancy stock raising is carried on successfully in various parts of the County, some giving especial attention to the raising and training of horses. Our hill farms, while not as productive as a rule as our river farms, produce better crops of wheat and oats, and are better adapted to mixed farming. Three or four first class creameries are being operated in the County, and many of our best farmers are relieving their wives and daughters of the burdens of the dairy work by taking to these creameries their milk or cream.

Nearly every farm in the County of any size has a sugar orchard of from 300 to 3,000 trees. The manufacture of maple sugar is largely engaged in, and the industry pays a good profit for the time and capital invested. Most of the large orchards are fitted up with the best appliances, and it is the ambition of the producers to turn out a first class article of honey or sugar.

The industry that ranks next with us to farming in magnitude and importance is the manufacture of hard and soft wood lumber. Saw mills and dressing mills are found on every hand doing a profitable business, and giving employment at good wages to hundreds of laborers. The manufacture of shingles and butter tubs is quite largely carried on in some of our towns. In the nature of things these industries must terminate with the death of our forests; but apparently, such towns as Belvidere, Eden, and Johnson, have a wealth of growing timber that will withstand the axe of the lumberman for another generation, at least.

Waterville, Johnson, Morristown, and Wolcott have some of the finest water powers in the State, waiting to be harnessed to machinery.

Mines of lead and copper are found in the County, but mining in the past has not been one of the industries of the County. At present, however, the prospect is that the rich copper mines at Wolcott will be developed. An English company has taken hold of the matter, a shaft has been sunk, and the outlook is that in the near future the work will be actively pushed.

In Waterville there is an inexhaustible quarry of soapstone, pronounced by experts to be of the finest quality, which in the past has been but feebly and partially worked. It would seem that here energy and capital might be expended with the assurance of a rich return.

So much for the natural resources of our County; and while we are proud of them, our greatest pride is in the character of our law-abiding people, a homogeneous population that has largely "grown up with the country." We are proud of our splendid educational advantages, of our homes of culture and refinement, of our churches and other agencies that are working for the social, moral, and religious well-being of our various communities.

Let the stranger come, for business or recreation. He is sure to find the atmosphere homelike. While we can not introduce him to that stretch of "magnificent distances" which he may find elsewhere, he may feast his eyes on the choicest specimens of New England scenery, and mingle in a typical New England community.

#### ORANGE COUNTY.

The County of Orange is one of the central Counties of the State, bordering the Connecticut River on the east, Windsor County on the south and Addison, Washington and Caledonia Counties on the west and north. The Connecticut River and its branches, Wells River, Waits River and Ompomponoosac water the eastern portion. Many mill privileges with excellent water power are afforded, some of which are utilized in various manufacturing industries, and along these streams is found excellent farming land. The central portion is watered by the first branch of White River which flows southerly nearly the entire length of the County. The western part is watered by the third branch of White River and Ayers brook.

The general surface of the County is quite hilly, but the hills are not so high as to render them unfit for farming purposes, and in many sections the richest farming land is found on the height of land. This is found to be the case particularly in the town of Randolph. There is but little land in this County unfit for agricultural purposes. Where by reason of being rough or stony it is unfit for tillage, it affords excellent pasturage. The soil is generally strong and of great variety, and all farm crops are produced in great abundance and with much certainty. Few sections of the country have suffered less from drouth or rain than this County, as the soil is of a character that does not easily become parched and is steep enough to drain off any rain-fall in one or two days. Though not especially a fruit section, apples thrive very well and many are raised. According to the census of 1880 the value of the orchard products was \$72,000, only three Counties producing a greater value. The total value of farm products was \$1,897,000, giving the fifth place among the Counties of the State. The stock

of this County is of a mixed character, being about equally divided between horses, cattle and sheep, and the character of the lands of the County require that this condition of things continue, as many farms unfitted for dairying by reason of distant or rough pastures make good returns from raising sheep and colts. The people, as a class, are industrious, frugal and fairly prosperous. About sixty farms in the County are reported without tenants. Many of these are operated in connection with some other farm where the owner lives and are not for sale. Others which are for sale are believed to be good farms, and the reason for selling is very often to settle an estate. Several have been purchased within the past year.

#### RAILROADS.

The County is well provided with railroads, the Central passing across the south-western portion, the Passumpsic along the eastern boundary its entire length, and a branch line from Barre to Williamstown which is expected to continue southerly and connect with the Central at an early day and afford increased service to the central towns of the County.

#### MANUFACTURING.

Though this County is very largely agricultural, it has considerable manufacturing. Nearly every town is provided with grist and saw mills, and in many towns the product from the saw mills, is a large item of income. Quite extensive tracts of timber are found in the northern and western portion, and the business of manufacturing both spruce and hard wood has been profitable and afforded employment to a large number of men. Aside from this branch of manufacturing are found at West Randolph, mills manufacturing sash and blinds, butter tubs, furniture and window screens; at Brookfield, hoes and forks; at Williamstown, granite; at Newbury, chair furniture, paper and boxes; at Strafford, bedsteads; Topsham, bobbins; at Thetford a large fishing rod manufactory has been quite successful. Vershire is the location of the Ely copper mine, which has passed through many changes of

ownership in the past few years. This mine formerly employed several hundred men and is now being operated to some extent. Many smaller mills are found in nearly every town, and most every town can offer good opportunities for increasing this branch of industry.

#### SUMMER RESORTS.

Few sections can afford more attractions than this County for summer travel. The roads are the finest to be found, the trout streams numberless, and views of mountain scenery unsurpassed. Until very recently little has been done in this direction, but every effort has been responded to in a way to encourage others to follow in this line. Two years ago the Maplewood was opened at Randolph Centre for summer boarders, with accommodations for about one hundred persons. It was filled from the beginning, and though additions are constantly being made, it is found impossible to accommodate the business which comes to it. Private families have only to consent in order to have their houses filled. At Fairlee Lake something is done in the way of attracting this travel; also at Chelsea, and in a small way in several towns. Not a tenth part is done in this direction that might be, and very many sections have tracts of land for sale that would make fine summer homes.

#### ORLEANS COUNTY.

Orleans County does not acknowledge the charge of the deserted farms and lands in the market at \$2.00 to \$4.00 an acre. There are no deserted farms within her borders: her inhabitants are not to any great extent searching for homes or business elsewhere. She has felt in a measure, in common with all portions of the country, the depression in prices of farms and farm products, and the general stress upon the industries; but she has resisted such pressure more easily and nobly than many sections, and is better prepared to respond at once to more prosperous conditions, and ready to improve all favoring circumstances. This is largely due to her varied resources. We venture the assertion that there is less waste land in this County than any other in the State, and

therefore proportionally a greater number of acres that can be profitably tilled. The soil generally is strong, adapted not only to grazing, but to the production of all kinds of crops that thrive in this latitude. The four principal rivers, Barton, Black, Clyde, and Mississquoi, with their numerous tributary brooks, well water the entire County, affording not only the finest pasturage and extensive and choice meadow lands, but also furnishing at very many points the finest possible power for varied manufacturing industries. Large portions of every town are specially adapted to dairy purposes. Large and fine dairy farms are found in all sections, several creameries are in successful operation, while our progressive farmers are adopting all the best and most improved methods and appliances, yielding a gilt edge product which brings the highest prices. We have not at hand statistics as proof, but the fact remains that Orleans County is rapidly reaching the front in the amount and quality of her dairy products.

The facilities for sheep husbandry are equally good, while not a few are successfully raising and fattening cattle for market.

This county offers a special and very strong inducement in the mixed nature of farming operations, to which she is admirably adapted. Main dependence need not be placed upon any particular product. All the main crops are practically sure with proper culture. Corn, oats, wheat and potatoes yield bountiful crops, while in some localities the growing of vegetables and small fruits is being made very profitable. This is eminently true in Newport and Derby, in proximity to Lake Memphremagog. Large quantities of onions, squashes, and cabbages are annually raised, not only for home consumption, but for more distant markets, finding ready sales at profitable prices. In this locality, too, immense quantities of potatoes are raised yearly and sent early to market, bringing the highest prices. These potato fields in late years range from five to sixty acres. For all these products, as well as for berries and early fruit, there is always a ready market, offering strong incentives not only to large farmers, but especially to those having but small acreage or limited means. There is easy access to market, daily fast trains from all railroad points transporting perishable freights at reasonable rates. No portion of the country to-day

offers greater inducements to the dairyman, the stock raiser, or general farmer than does Orleans County.

Increasing attention is being given to horse breeding, and several large and successful stock farms are rearing the finest bred horses the country has ever seen, these all commanding fine prices at ready sale.

Nor are her resources confined to those already mentioned. The timber has by no means been exhausted, and in many of the towns large lumbering operations are being carried on. Mills, greater or less, are found all along our streams. In most sections it is true that within a few years this interest will diminish, and the forests will have been cleared, but in other localities, as at Newport and other towns along the Canadian border, the supply will hold for many years to come. Lumber companies at Newport now own timber lands in Canada sufficient to supply their mills for the next quarter century. The logs are conveyed to the mills both by water and rail, and a very large business is done in the manufacture of lumber in all forms, including veneers, pulp and paper. A large number of men are employed in these works. There are similar lumber mills, though smaller, in Lowell, Westfield, Jay, Troy, Barton, Barton Landing, Holland, Charleston, Coventry, Irasburgh, Greensboro, Westmore and Morgan, all combined employing an army of men during the greater portion of the winter—the dull season—in cutting and hauling stock. There is a constant demand for day laborers, and all worthy ones can secure employment at good prices.

The unemployed power along our rivers offers the very strongest inducement not only to home, but foreign capital. At Barton, at Charleston, and all along the Clyde in Derby is a large number of the finest water privileges in all the country. These streams, issuing from large lakes or ponds, or a succession of them, are steady in flow and inexhaustible. A great number of these privileges are waiting to be utilized. Convenient railroad facilities, the reasonable prices of labor and supplies, the distance from any great center of foreign population removing the danger of strikes or other labor troubles—these, with many other considerations that

might be urged, offer the very strongest possible inducements to manufacturing companies seeking the best locations.

While we can not boast of extensive quarries and mines, there are in Derby as fine granite beds as can be found anywhere. The stone is of fine color, deposited in layers, splits true, works easily, and receives the finest polish. It finds a ready sale, and is destined, we believe, to become an important factor in the business growth of the town.

To the tourist, the summer boarder, the seeker after health and pleasure, special attractions are everywhere offered. The climate is unexcelled, the scenery in variety and beauty unsurpassed. These resorts, several of them, are already well known, and are being fairly patronized ; when better known and understood, they are destined to play a most important part in the future growth and prosperity of the County. Notable among these places of interest and offering special and prominent attractions are Lake Memphremagog, Willoughby Lake, Caspian Lake in Greensboro, Crystal Lake in Barton, and Seymour Lake in Morgan. There are steamers, large or small, on each of these lakes for the use and pleasure of guests ; there is abundance of fish ready for the taking ; there are beautiful drives and walks in all directions ; beautiful and varied scenery as can anywhere be found, with rest, quiet and solid enjoyment for all—tourist, boarder, invalid, or pleasure-seeker. To these more prominent places may be added a multitude of quiet villages and thrifty hillside farms, offering pleasant, quiet, and attractive homes to the summer guest.

To all these attractions add the benefits of a moral and religious atmosphere, with easy access to places of worship, with the privileges, in the neighborhood of larger villages, of libraries, lectures, musical entertainments, and no better place can anywhere be found for the capitalist, the laborer, the transient, or the permanent home than Orleans County can offer. The half has not been told, but come and see us and we will do thee good.

#### RUTLAND COUNTY.

Rutland County is situated in the western part of the State, bordering on Lake Champlain and the State of New York. It is



the most populous and wealthy County in the State, and its agricultural productions excel any other.

There are two ranges of mountains extending through the County from south to north, viz., the Green Mountain and Taconic ranges, nearly parallel to each other. Killington Peak, one of the highest in the State (4,221 feet above the ocean), boasts of a hotel near the summit which is quite a popular resort, being well patronized during the summer months. Other places of note to those seeking rest and recreation from the cities may be mentioned—Clarendon Springs, Middletown Springs, Lake Bomoseen, Hyde Manor in Sudbury, and others of lesser note.

Otter Creek, the longest river in the State, rises just south of our southern boundary, and flows northerly through the County. It affords excellent water power at Wallingford, Center Rutland, and Proctor. The valley through which it flows increases in width as the river increases in size, and is very productive. It is natural grass land, and the higher portions are good for corn and other grains.

The principal business of the farmers is dairying, though forty years ago sheep occupied the ground where now we find cattle and horses.

The County is peculiarly adapted to sheep husbandry, as the lands of the valleys and those adjacent are natural meadows, while those on the hills too rough for cultivation are excellent pastures.

The consumers in this County are increasing much more rapidly than the producers, so much so that the outlook for a good home market for all the farm produce is very flattering. Rutland with its 12,000 inhabitants, and the towns of Proctor, West Rutland, Fair Haven, and Brandon, all very flourishing, demand a very large share of the produce now grown in the County, and market gardening is yearly being extended further from the centers of the larger villages; and as these manufacturing centers increase in size, so do the farm lands in like ratio increase in value, where they are located near enough to take advantage of their markets.

There are still considerable original forests standing in the County, and lumbering is carried on quite extensively, more particularly in Danby, Mt. Tabor, Mt. Holly, Shrewsbury, Mendon,

Pittsfield, and Chittenden. This business employs a large number of men and teams the year around.

#### MARBLE.

Without doubt the most flourishing business in the State is the marble industry, and the supply is inexhaustible. Beginning with Danby on the south and passing through Wallingford, Clarendon, West Rutland, Proctor, Pittsford, and Brandon, there is an unlimited amount, and it is being successfully worked in all these towns, and the demand for it is constantly increasing.

From a circular issued by the Rutland Board of Trade, we copy the following: "More marble is quarried and manufactured within a radius of six miles of Rutland than all the rest of the world combined, over 4,000 men being employed. This industry is yet in its infancy, and there is seemingly no limit to its profitable development. It has already made Rutland a city of magnificent buildings, and one of the wealthiest of its size in the country."

Next to the marble comes the quarrying and manufacture of slate. This business forms one of the leading industries of the County, and proves remunerative to those who have embarked in the enterprise of working the quarries. Like the marble, the supply is unlimited, and the demand increasing. Most of it is used for roofing, but very large quantities are sawed for billiard tables, mantles, etc. Although this industry is not as old as that of marble, its development has been more rapid, and it promises in the near future to greatly increase.

#### WASHINGTON COUNTY.

Washington County is the central County of the State. It occupies substantially all the upper half of the Winooski Valley from its head in Cabot to the west line of Chittenden County. The main branches of the Winooski in this County are Kingsbury Branch and Waterbury River. With these and the nearly one hundred ponds, the innumerable brooks and mountain rills, the

gushing springs from every hill side, it is well watered. It is emphatically the "Land of forest, lake and mountain river."

It is almost wholly an agricultural County, and one of the best food producing regions in the country. Originally wooded with a heavy growth of maple, birch, beech, ash, elm, spruce, hemlock and pine, it became, when cleared, good strong soil fitted for the immense crops of grass, oats, wheat, corn, potatoes, barley, rye, etc., etc., that have been raised for over a hundred years in the Winooski Valley, without any general failure. Fifty to seventy-five bushels of corn are raised on the river meadows, and on the uplands seventy-five to one hundred bushels of oats, or three hundred to five-hundred of potatoes, are often harvested from an acre. The hay crop averages over a ton to the acre, while the pastures feed about 7,000 horses, 1,400 oxen, 21,000 cows, 11,000 young cattle, and 13,000 sheep. Our annual clip of wool is 130,000 pounds, yearly make of butter over 3,000,000 pounds, maple sugar 1,400,000 pounds, (the largest amount of sugar and syrup of any County in the State.)

On the whole, although mountainous and hilly, this County equals in quantity and quality of productions any in the State and probably it equals that of the same amount of hill land in the whole country.

Besides these fine farming facilities this County has the honor of having the capital of the State. The State House, State Library, State and U. S. Supreme Court buildings, State Cabinet and also the County buildings at Montpelier, a thrifty and prosperous village in the center of the County. Montpelier is not only rich in public buildings, but also in churches, schools, mercantile, banking, insurance and other corporate or individual enterprises. It is, in fact, for its size, one of the busiest, liveliest and richest towns of the State.

Barre is the most populous town in the County, having gained about 4,000 in the last decade. Here is the head center of the granite works, employing several thousand men and some millions of capital, and the business is increasing rapidly. This granite is of the finest quality and is seemingly inexhaustible in quantity. Three railroads have been built within the last few years to this

town, mainly to accommodate this work. The same formation of granite extends through Berlin, Plainfield, Marshfield, Cabot and Woodbury. Many fine quarries are now being opened in the towns of Woodbury and Hardwick and a branch railway is being constructed to them. Through Roxbury, Northfield, Berlin, Montpelier, East Montpelier, Calais and Woodbury extends a broad belt of clay slate, in which several quarries have been opened at Northfield and one at Montpelier.

Northfield is a good farming town, and is the seat of Norwich University, a fine military and classical institution. It is also a town of considerable manufactures of various kinds.

Waterbury is a flourishing and wealthy farming town, and has the State Insane Asylum.

Waitsfield, Berlin, East Montpelier, Plainfield, Calais, Barre and Cabot are among the best farming towns in the State. Warren, Fayston, Moretown, Middlesex, Worcester, Roxbury, Woodbury, Marshfield and Duxbury all contain much fine land, together with much forest and broken or stony land.

Land is wonderfully cheap in some of these hill towns. Good old homesteads, with substantial and convenient buildings, with the purest of spring water at house and barns, and the finest scenery on earth all around, are offered for from \$10 to \$20 per acre, often less than the buildings would cost, while farms with poorer buildings and conveniences can be had from \$5 to \$10 per acre, and most of these lands are, or might easily be made to be, wonderfully productive.

The numerous saw mills on the rivers and brooks furnish a good market for lumber. The railroads are convenient for shipping all the products of the farm or forest to market. Our roads, schools and churches are first-class, our fishing and hunting should please the sportsman, our climate is healthful, our scenery beautiful. Just why a person should want a better place to live in than Washington County, Vermont, or a better place to move into, is one of the things past finding out.

## WINDHAM COUNTY.

This County, from its geographical position, and being in close connection with Boston and the large manufacturing towns of New England, has every facility for marketing all the products of the farm or factory. With railroads extending the entire length of the County, and from Brattleboro to Londonderry, also up the Deerfield Valley extending to Wilmington, and with electric communication, one town with another, all with the business world, good transportation as well as business facilities are afforded.

The line of towns bordering on the Connecticut river comprise what is known as "Connecticut River Valley," which for farming purposes is not surpassed in New England. The soil, rich and easily tilled, produces abundant crops. The various grains, and especially corn, grow to perfection. Fruits are abundant and of excellent quality. Vegetable raising, or market gardening, is quite extensive and very profitable. This valley is noted for its many fine herds of thoroughbred stock, and for the excellence of its dairy products.

The towns of higher altitude are well adapted to agricultural purposes. When beef raising was remunerative, here the Short-horn cattle grew to perfection; since that industry has changed, the farmers have taken up dairying, sheep husbandry, and the raising of horses. The farmers are intelligent, well-to-do, and thrifty. Their creamery products are the best, their mutton excellent, and their horses the true *Vermont* horses.

Deerfield Valley is a place of beauty as well as enterprise. Here is the town and village of Wilmington, noted for its thrift, enterprise, well kept farms, and well regulated community. It has a large number of prosperous farmers. More maple sugar is made here than in any other town in the State. A flourishing co-operative creamery gives impetus to the dairy business. There was recently built the elegant summer hotel, Raponda, on the shore of the beautiful lake of that name. This house will be filled with guests the coming summer. An extension of the Deerfield Valley railroad to this place is now being built, making connections with the Fitchburg at Hoosac Tunnel. This extension gives new life and energy to a large section, including the towns of Whitingham and Dover.

There is a good home market in the large manufacturing towns of the County. Bellows Falls, with its immense water power, does a large manufacturing business. Its well kept village, elegant residences, and all the surroundings, make it a desirable place for homes as well as for business.

Brattleboro, with its 7,000 inhabitants, has extensive and prosperous manufactures, large business houses, admirable buildings, both public and private, schools and churches of the first order, clean streets, beautiful drives, grand scenery, and with the free and generous spirit of its cultured people is attracting city people of wealth, who are building there their summer homes.

#### WINDSOR COUNTY.

In all fair and fertile Vermont there is no section that surpasses Windsor County in beauty of scenery, richness of soil, value and grade of flocks and herds, or in the comfort of its homes and intelligence of its people. It is no exaggeration to say that it would be difficult to find in all New England a rural County with greater attractions to the seeker of a permanent home for the pursuit of agriculture, or to the tourist in pursuit of a summer's pleasure. Its attractions of mountain and glen, forest and stream, include the far famed Ascutney Mountain, and Mount Tom with its ten miles of unrivalled drives. From every hill top one can gain magnificent views of the White and Green Mountains, while the quieter beauty along the streams in the valleys enchant with the music of the waters and delicate tracery of foliage.

The beauty and grandeur of Vermont scenery are coming to be recognized by an ever increasing number of tourists, who find the charms of her valleys and visions from her mountains as delightful and as extensive as any in New England. Windsor County already is becoming the summer home of men of wealth who are purchasing farms and sites for cottages and mansions in which to spend the season with their families and friends.

Windsor County not only owes much to her natural beauty, but also to the enterprise and thrift of her people who have adorned

their farms with homes of comfort, and surrounded them with evidences of a cultured and refined taste.

The Connecticut River forms the eastern line of Windsor County. The land stretches from the valley westward in swelling hills till resting at the base of the Green Mountain range. This slope is intersected by three rivers, which rise in the Green Mountains and flow eastward to the Connecticut. Along these streams are many undeveloped water powers awaiting the enterprise of manufacturers, who ere long will recognize the advantages Vermont affords. It is a curious fact that this natural resource of the State has been so little utilized. It is only four years since one of the greatest water powers of the Connecticut, located in Windsor County, has been utilized, and an extensive plant, costing \$400,000, erected.

The soil of Windsor County is exceedingly rich, not only in the valleys, but on the hills. Worked by an intelligent and progressive population, the effort is made constantly to enrich the soil and increase its productions, so that it will not do to say the farms in the valley are superior to many upon the hills. Some of the towns in this County are located entirely upon the uplands, and are as fertile as any in the valleys, under the management of men who as agriculturists and as citizens are the pride and boast of the State. In this County are some of the most famous herds of Jersey cattle in the country. The prize Southdown and Shropshire sheep of the State are here, and here is the home of some of the men who have a world wide reputation in connection with the finest Merino sheep in the world. It is in all respects well adapted to the principal agricultural interests of Vermont — dairying, sheep, horses, and fruit.

There are very few of the so-called abandoned farms in this County, and yet there is always an opportunity to purchase desirable locations by those who are seeking a permanent residence as agriculturists, to whom some of the refinements and comforts of life are a consideration.

There are also numberless opportunities for those who are seeking sites for summer homes, to secure in almost any part of the County locations commanding all the grandeur and beauty of mountain,

forest, and stream, while the manufacturer will do well to consider the opportunities for power afforded by the streams of the County and of the State.

#### THE DAIRY INTEREST.

For the past fifteen or twenty years, the leading industry of Vermont has been her dairy interest. About the middle of the present century the talented and eccentric Saxe, "poet, editor and man," was asked what the Green Mountain State excelled in of all her products, and his ready answer was "women," and he added, "maple sugar and Morgan horses." The present methods adopted in the dairy, have preserved our standard in the production of the first named staple. Continued high prices (until the present year) of imported sweets have fostered a continued production up to the standard of our maple products, and only the last, "Morgan horses," have been "o'er shadowed" by the comparatively new industry, the cow. Our tables of reference, in order to show the comparative increase of the cows of Vermont for the last ten years, are as yet in blank, but observers who have had rare opportunities to obtain information on this subject, give the numbers as only a slight increase over the census returns of 1880, viz. : 350,000 cows. In order to show what value this industry is to the State, we must needs compute the product, and while *numbers* are not much in excess of the period for the past decade the intelligent farmers and dairymen of the State have given their attention to an improved quality of stock, till now, in place of cows yielding but 150 pounds of butter per head, we find the average brought up largely, and good large herds, whose product is *more than double* the figures of 1880. Were we advertising individual herds, we could name several of 300 pounds production, and even higher; and during the past winter a modest man up in one of the northern Counties, showed a table of records, where by care in breeding, he had brought a herd of more than twenty animals up and up, year after year, till they yielded him the almost fabulous product of three hundred and seventy-four pounds per head. That this can be the average for the State we do not contend, but there is no spot on earth, where it can be accomplished, if not in Vermont. The



sweet and luxuriant pastures, exceptionally fine quality of English hay, and the ne plus ultra in water supply, will prove to any one that no State has a better prospect of success in this line of agriculture, than has Vermont.

Our present number of cows, yielding on an average but 200 pounds of butter, or a proportionate amount of cheese, with a population of a little less number than the cows, giving each individual of the State 50 pounds per annum of butter, would still leave us for export something over 50,000,000 pounds of butter per year, to which amount it would be an easy matter to add by increased production, another 25,000,000 pounds at a comparatively small added cost. It gives us pleasure to call attention to the new venture in the manufacture of butter by the Franklin County Creamery Association, where the output is now, less than two months after its starting, more than 10,000 pounds of butter a day, or something like 75,000 pounds per week, and still increasing. This venture, started at the suggestion of the intelligent men of that County, has not yet had its first anniversary, and still we hear of suggestions of concentrating the manufacture of butter in Vermont until the entire output shall be made in about four of these mammoth establishments—by this means reducing the cost of making to a minimum, and securing not alone a more uniform article, but by concentrating efforts and shipping in large amounts, or holding in cold storage as shall seem best, get the product into market to better advantage than is now possible, and giving better net returns to the producer than even the best arranged creameries of to-day can possibly do.

That this is not visionary has already been abundantly proved, and even the white haired men and matrons of to-day may see in the near future still greater revolutions in the dairy than the past twenty-five years have made. When, in place of the surplus of five million pounds, twenty years ago, or the present surplus of over fifty million pounds of butter, we can place one hundred and fifty million pounds of butter outside the State without increasing the number of our cows, we shall feel that Vermont dairying is a perfect success; and we feel sure that the brains of our dairymen are capable of accomplishing this and even greater results. It will

be shown by those more capable than the writer of this article, that in the product of cereals our State leads the list, producing more corn, more wheat, more rye, barley, oats, and buckwheat per acre than any other State in the Union.

We have already stated that the water supply was all that could be desired, and that the quality of her grasses was perfection for hay or grazing ; and we feel inclined to venture the assertion that Vermont leads the States in the amount and value of her dairy products per cow. It is certain that dairying is only now in its infancy, and what the future has in store for us is only to be measured by the amount of energy and intelligence our dairymen exhibit in their pursuit of success in this direction.

Our confidence in the State is unbounded, and we have the fullest faith that dairying in Vermont will prove one of the great industries which will lift the farmers of our State out of the discouragements of to-day into the success and enjoyments of the morrow.

#### CONDENSED MILK.

Vermont is essentially a dairy State. Vermont butter and Vermont cheese have a reputation among consumers that, like Vermont maple sugar, gives the highest market value and ready sale to the product bearing even the external testimony of a label that the article was made in Vermont. Sweet pastures, fertile soil, pure air and crystal streams, combined with skill in manufacture, constitute the foundation of this enviable reputation. The natural advantages will always belong to Vermont. Of these God has given the State a monopoly, and he has given the people the intelligence to maintain and improve them. A dairy State, Vermont has large herds of cows, and she has hundreds of thousands of acres for the pasturage and support of other herds, could the dairy interest be made somewhat more remunerative and the income less uncertain. To this end, and in view of all the facts of the situation, it is desirable to "diversify", to enlarge the uses for milk. The manufacture of condensed milk, an established article of commerce for which there is a large and growing demand, affords the means of diversifying, of enlarging,

the uses of the product of Vermont dairies. On this subject THE VERMONT WATCHMAN, published at Montpelier, in a recent editorial article said:

We have repeatedly called the attention of Vermont people to this industry, and the great natural advantages the State possesses for the manufacture of condensed milk, and the prestige her reputation as a dairy State would instantly give this product. There are millions in the trade-mark, "Vermont Condensed Milk." It would have all over the world the precedence given to all Vermont farm products. "Vermont Maple Sugar" is a brand that is a sure guaranty of sale of the article that bears it, at the highest market rate. So would it be with "Vermont Condensed Milk." Her pure water and sweet pastures would impart to this product the same unrivaled excellence favorable local conditions give her sugar. Butter and cheese would cease to be the sole resource of the dairy farmer. The presence of a condensed milk factory at Montpelier, for example, would add another string to the bow of the dairy interest that centers here, and the capital of the State ought to lead in the introduction of this industry into Vermont. An old, well-established and profitable industry elsewhere, it is new to the soil that should have been the first to nourish it. The article made here would carry in its name a voucher that it is the unadulterated product of the best dairies in the country, not a vile imitation, compounded of cotton-seed oil, swill milk and sugar.

There are only six condensed milk factories in this country, and none of them are in New England. They are situated near large business centers where farming lands are many times the price of Vermont farm lands. A factory has however, recently been started at Newport, Me., which, when completed, will require 45,000 quarts of milk daily, or the product of 4,000 cows. It will also give employment to 100 people.

Condensed milk is the product of pure milk reduced to about one-sixth its natural bulk, preserved with sugar and hermetically sealed. This product is used largely on ship board, in the army, on the frontiers and in mining communities, and by many families in cities and large towns where pure milk is not easily obtainable. Now, Vermont with her unequalled natural advantages, with her

cheap lands and with her abundant capital—so abundant that millions of her “surplus” have been dumped into all sorts of wild cat enterprises outside the State—presents every condition, every advantage for the successful prosecution of this industry. In the manufacture of condensed milk may be found the most advantageous single factor in the solution of the question of the profitable reclamation of her abandoned farms, her farms that are better adapted to pasturage than to tillage. The value of the farms advertised in this work, would unquestionably be more than doubled by the building of a condensed milk factory within a reasonable radius of their locality.

“There is a tide in the affairs of man,  
Which, taken at the flood, leads on to fortune.”

Let Vermont embark on this tide at its flood, and float the farmer out of the “shallows and miseries” that binds “the voyage of his life.”

#### HORSES.

There is no State that has greater natural advantages for the production of horses than Vermont. Despite the hap-hazard and unbusiness-like way it has always been managed, she stands to-day at the head for the production of serviceable driving horses, and it would seem wise for all farmers who have horses to raise a few for the market.

There is something about the soil and climate that produces naturally a tough, hardy horse, of enduring strength. There is in the foundation stock of the State one of the best families of horses in the world. There is to-day and has been for years an unsupplied demand for just the horses we are raising, and at good prices. There is less risk in the production of this class than in any other. Considering all things, we have not the abundant supply of cheap food to enable us to raise draft horses and compete with the West, nor can we use, as a rule, a strictly draft horse. Our farms do not require it, nor do we require them to draw our produce to market.

The production of trotters is too risky ; it requires too large

an outlay of capital for the ordinary farmer, and they are of little value for the ordinary work of life.

There is a class of horses frequently found in Vermont, and it could easily be produced from the foundation stock of the State. This would not only supply the necessary horse labor of the farmers, but would, when fitted for market, find ready buyers at paying prices.

The horse that I believe is in the best demand to-day, and from which may be realized the most profit, is the so-called gentleman's driver or light carriage horse. They must stand from 15½ to 16 hands high, weigh from 1,000 to 1,200 pounds, of any dark color, including sorrel or light chestnut, handsome shape and stylish looking, able to trot in about four minutes, and do it in a bold manner, with rather high knee and hock action. Horses of this class readily command good prices ranging from two hundred upwards, according to quality. The native Morgan stock has all the above qualities except size, and it only needs a little more care in selection, a little better feeding when young, to increase largely the number of horses of this class.

One great advantage in raising this class is that at three years old they may be put to work on the farm and made to pay their way until sold. While labor on the farm might injure a trotter and prevent his winning a race by a second or two, it in no way unfits him for a stylish road horse or lessens his ability to pull a carriage at a spanking gait. A few years ago there was experienced a difficulty in finding stallions of good quality and size to cross on our blocky Morgan mares, but it is not so to-day, and any farmer who has a good mare, sound, kind and resolute, may easily find a proper mate, at a reasonable price, and be almost certain of raising a colt that will pay all the cost of raising and give a fair prospect of a profit. It always seems wise to produce what the public demand, if it can be done at a profit; and there is, I believe, today no business in Vermont that in a limited or extended scale will pay the profit that the breeding and fitting of the above desirable horses will return to the investor. While the draft horse fills only one want, while the small trotter is of no value if not fast, this class of horses is adapt-

ed to all the above uses, except heavy draft ; and I believe, in following the above line of breeding, a fair proportion of colts will prove trotters and sell for such.

You hear it said that horses are plenty and may be bought low, and it is true of Western horses and a class of common draft horses ; but let a man go out and attempt to buy one or more good drivers, not fast horses, not trotters, but simply good road horses, and it is hard to find one over five years old. He will be compelled to go home without or take a four or five-year-old colt, and at a price from two to three hundred dollars.

Why is not this business a better one than Western farming, and one that would pay well for the investment of capital ? It is, I believe, an undeveloped source of wealth, and one not likely to be overdone ; for no other country has the natural advantages that are found in the stock at hand, the soil and climate, and the market at one's door. Buyers come here, are continually through the horse sections of the State, picking up every promising colt as soon as old enough, and often engaging them ahead to be certain of getting them.

C. M. WINSLOW.

#### SHEEP.

The raising of sheep has always occupied a prominent place in Vermont farming. In former times it was the *one* source upon which the farmer depended for cash returns, his other products being subjects of barter and trade at the country store or among his neighbors. The product of the flock was then the wool, but little account being taken of mutton, and there was little inducement to grow mutton, as it was little sought for in our markets, and all surplus sheep were wanted to build up other flocks. At the present time the condition of the business has changed ; other lines of farming have been developed. Dairying and the rearing of horses have largely increased and become rival industries. The markets have undergone marked changes ; while the price of wool ranges lower, the price of mutton rules higher, and the demand for breeding stock continues good. And while in former times the Vermont shepherd was mainly anxious to have wool sell at a high price, to-day the product of wool is of secondary importance. We may say,

perhaps, that sheep raising in Vermont today is conducted upon two distinct lines, though there are some who take a middle course; but the successful sheep men of the State are, as a rule, breeding for mutton or for the roughbred Merinos.

#### MERINO SHEEP.

The history of the introduction, improvement, and success of the Merino sheep in Vermont is too long to be reported here. It is sufficient to say that they came here from Spain, and found a soil, a climate, and men suited to take them and carry them forward to their greatest perfection and in competition with the world. Vermont stands first in this class of stock, and today finds market for surplus stock throughout the great sheep raising sections of our new States and Territories, in Australia, in South America, and is now making an attempt to build up a trade in Southern Africa. The price received for this stock varies with the year and quality of the animals, but has hardly ever been so low, for any length of time, as to not pay a fair return for rearing, and sometimes has commanded prices almost fabulous. Many fortunes have been made—and some lost—in this business and whatever might be said as to the individual success or failure, it is undoubtedly true that no business, employing anything like the same capital, has ever brought as much money into the State as has the Merino sheep. This business is mainly confined to one County in the State, Addison, though breeders are found scattered through Rutland, Windsor, and Orange Counties, and some others. The men engaged in breeding this stock are few in number and generally have followed the business for many years, and though this business might be enlarged with profit, there are comparatively few who have a taste for it, as the returns lack somewhat of the element of certainty. Whatever may be lacking in the way of a ready market in the thoroughbred Merino, business is made good to the grower of

#### MUTTON SHEEP.

No business in the State has enjoyed so steady and remunerative market as this branch of sheep husbandry, and the increasing

demand of our New England cities and large towns for nice mutton is giving an impetus to this business that bids fair to restock all our available lands. Much attention is being given to the raising of mutton lambs that are ready for market in May and June. Our nearness to market, cheap lands, and sweet grasses are advantages that ensure success in this work. The opportunity for extending this business, as in many instances pasture land is too far away from the tillage to be fitted for dairying, or too rough to be safe for young horses or colts, but abounds in sweet and nutritious grasses that especially adapt them to growing the finest mutton or the hardiest sheep that can be produced.

#### MAPLE SUGAR PRODUCTION.

Of the industries peculiarly adapted to Vermont, perhaps none takes the pre-eminent position occupied by our production of maple sugar. With our small area this product exceeds that of any other State. While this is true, it is also a fact that this industry is capable of great extension, and instead of a product of fifteen million pounds it is easily possible to increase to twenty-five or thirty million pounds, or double our present production. The manufacture of this product dates back to the earliest settlement of our State, and few industries present a more striking illustration of the improved methods of the present as compared with the past than this one. The farmer of fifty years ago boiled sap in a five pail iron kettle hung upon a pole over a fire of green wood, making fifteen to twenty pounds of inferior sugar per day, tapping his trees with an axe and catching the sap in troughs dug from bass wood logs, storing his sap in old hogsheads or barrels, and producing a combination of charcoal and sugar. Compared with the sugar-maker of today, with good sugar house, modern evaporators, tin or pine buckets with covers, with storage tubs clean and nice enough to set milk in, producing from one hundred to two hundred pounds of sugar per day for each evaporator used, as striking a contrast between the past and present is presented as is often seen. It is little wonder that people familiar with the methods of thirty or forty years ago should pronounce the fine pro-



duct of the present to be an imitation article, because lacking in the high color and charcoal taste of former days. As conducted at the present day, the manufacture of maple sugar is one of the most profitable industries of the State. The work comes at a time when the farmer has little else that he can do ; this product is being sought for throughout the country as an article of luxury and the best sells at good prices.

The maple syrup usually sells at 75 cents to \$1.25 per gallon, and nice tub sugar or cakes at eight to fifteen cents per pound. The great obstacle for the Vermont sugar producer to overcome at present is the competition of the adulterated and imitation maple sugar with which the markets are flooded. Probably ten pounds of so-called maple sugar and syrup is sold to every pound of pure that is produced, Chicago is said to produce several times as much maple sugar as Vermont, most of which is labelled "Pure Vermont syrup or sugar." This obstacle is being met to some extent by our maple sugar exchange, located at Brattleboro, which handles only pure goods, and by individual farmers who have established a trade for their own product. It is coming to be generally practiced by consumers of maple sugar to give their orders direct to producers and in this way be assured of a pure article at a fair price. The farmers of Vermont have little cause to fear an over-production in this line. Let them strive to give the people of the country, who ask for the product of the maple, a superior article which, once used, will be sufficient to show to the customer the difference between the pure and spurious. Were the people of the country who imagine themselves to be eating maple sugar dependent upon the maples for their supply, every maple we have would be insufficient to furnish it. We may reasonably expect that as the people become better educated in this product that the demand for the genuine will largely increase, and the business of producing maple sugar will enlarge and become more profitable with each succeeding year.

#### THE FISH AND GAME SUPPLY OF VERMONT.

United States Commissioner McDonald, having occasion to look into the leases of some Scotch rivers, reported that the Tay

alone rented for £40,000. It is said that \$140,000 of this represents rod privileges.

While our fishing is in a broad sense free, this statement illustrates to what extent fishermen will loosen their purse strings for the enjoyment of this invigorating sport. We have no river Tay stocked with salmon, but nestling among our green hills are between four and five hundred ponds and lakes with a total area of some 125,000 acres. As tributaries or outlets to these bodies of water, we have innumerable mountain streams which broaden into rivers as they flow into and through the valleys fertilized by them.

The majority of these waters are the native haunts of the speckled trout. In addition to the trout many of our waters abound in a great variety of fish, the leading ones being bass, land-locked salmon, salmon trout, pike, pike perch, and pickerel.

On our western border, and more than half of it within our limits, is historic Lake Champlain, noted for its beauty and remarkable for its varieties of fish. Many sportsmen are attracted to its shores by the abundance of aquatic birds in the vicinity. This may be said also of Lake Memphremagog on our northern border. For the hunter, partridges will always be the game which gives the most sport and the best results as a food supply. Nearly all the large game native to our forests has become extinct, but deer are increasing rapidly, as evidenced by the frequent reports of their being seen in our rural districts. Under the wise law enacted by our last Legislature, their protection from slaughter has been continued until November 1, 1900. At present they are very tame, and it is a question whether it will not be advisable to continue their protection for an indefinite period, as they would be quickly exterminated if the fostering care of the State were withdrawn.

Woodcock furnishes as good sport as in other States of New England. Quail have been introduced several times, but it appears doubtful if they can endure the severity of our winters.

English pheasants have recently been introduced by Dr. Webb at his Shelburne Farms, and the result of his experiment is watched with interest. Many new varieties of game birds would undoubtedly thrive in Vermont, and any efforts in this direction should receive the hearty endorsement of every one. Rabbits and

squirrels, though decreasing in numbers, are still abundant, and are a source of much sport to the hunter.

I have attempted to briefly state our resources in the way of fish and game supply. It has been asserted by the authorities in the Fish Commission and Geological Survey of the United States, that within a century the waters of this country will supply as much food as the land produces, and by that time water farms will have become as plentiful as land farms. Water farming is far more profitable even now, for a given area, than the tilling of the most fertile soil. Were it possible to obtain an accurate report of the fish and game taken in Vermont during one season, the value as a food supply would doubtless be surprising. The chief value to our State, however, is not in the fish and game themselves, either for the market or consumption as food. It is in the attraction afforded not only to residents of our State, but to the thousands of summer visitors who flock to our lakes and hills every season, that our fish and game supply is becoming such an important factor in the economy of every rural community.

With the efforts being put forth by the railroad companies, and very generally by the inhabitants, to call outside attention to the attractions of Vermont, it is but natural to expect summer tourists in greater numbers each year. If we would retain our hold upon this desirable element in the economy of our State, we must keep up our attractions.

Farmers are not without some reason when they make some such remark as "Fishermen are a nuisance, anyway." But they must admit when taking a broad view of the question, that the fishermen patronize the railroads, and cause better accommodations for everybody. They cause hotels to be built, and bring their families. They hire boats and guides, and patronize the country stores. Last, but not least, they buy our much abused "abandoned hillside farms," and make summer homes of them. The farmer sells his chickens, eggs, butter, lambs, etc., and gets a better price at home than formerly at a distant and uncertain market. It is the fisherman or summer tourist who creates the demand for what he raises, and he gets his pay in hard cash.

Clubs are being formed in various parts of the State, whose

membership is made up largely of non-residents. These clubs are buying up land for fish and game preserves. By damming the brooks to form ponds or a series of pools, many of our abandoned farms can be turned into fish and game preserves, indirectly more productive to the wealth of the State than many more fertile farms now under a state of cultivation.

It has been demonstrated in other States that artificial propagation will do much towards restoring depleted waters to their former condition. The New York Commissioners, in a recent report, say that there is better fishing to-day than when the Commission was organized some twenty years ago. There is nowhere a more practical illustration of the effects of restocking streams, perhaps, than in Rutland County, where some twelve years ago a few thousand rainbow trout escaped from a private pond into East Creek. About one in three trout now taken from this stream are the rainbow variety. Previous to this event the rainbow trout was unknown to our local fishermen. Several have been taken this year ranging in weight from one to three pounds. There is probably no State in New England in which so little practical attention has been paid, either to preserving what fish and game we have, or to restocking our woods and waters, as in Vermont. The Legislature has never made any appropriations which would permit a commission to devote its time to the subject of fish and game preservation and propagation. At the last session, however, in addition to the regular allowance to the commission, an appropriation was made sufficient to provide for the construction and maintenance of a hatchery. It is hoped that this will soon be "hatched," that we may lose no time in replenishing our depleted waters, and introduce new varieties for which our streams are so well adapted.

At the same session of the Legislature, the Vermont Fish and Game League was incorporated. Starting off with one hundred and twelve charter members, its numbers have steadily increased. It is a State institution, working for the benefit of all its inhabitants. Its membership roll is open to all citizens interested in the welfare of Vermont.

We have fish and game laws, too many of them, but they exist in many sections only to be disregarded. As in other States,

the greatest difficulties in the way of successful protection of fish and game are conflicting and misleading laws and ignorance of them. Experience in other States goes to show that a more proper observance of the laws follows the erection of a hatchery. Apparently influenced by the work of our own State in this matter, Congress made a liberal appropriation with which to purchase a site, and establish a U. S. hatchery within our limits. Thus with two hatcheries within the State, it only remains to secure proper legislation to protect our fry and young fish and see that the laws are enforced.

One of the most crying evils to-day and one which on certain streams would accomplish more by prevention than the hatcheries will accomplish by propagation, is the reckless discharge of sawdust, lime, refuse from gas houses, etc., into streams which would otherwise abound in fish. If the State engages in fish culture and would make a success of it, this evil must be corrected.

This article is written from a purely economic and business stand point. I will not enter into the details of the pleasure to be derived from fishing and shooting, or the recreation coming from such pure out-door sports. Our own citizens would be benefited if they would spare more time to themselves and encourage our youth in these healthful amusements.

With all the gifts of nature at our doors, let us show our appreciation of them. With a proper attention to our roads, a wise protection of our forests and a faithful attention to the work just inaugurated to increase our fish and game supply, Vermont will be truly called the Arcadia of America.

JOHN W. TITCOMB,  
Sec. Vt. Fish and Game League.

#### VERMONT'S MINERAL WEALTH.

It has almost been overlooked even by her own people that Vermont is rapidly taking front rank as possessing valuable mineral deposits.

In marble she now leads all other States. Estimating fairly those who failed to report, we find that in 1889 there was invested

in the marble business about six millions of capital ; nearly three thousand men were employed, receiving as wages and salaries about one million dollars. The out-put was about one million, seven hundred thousand cubic feet, valued at about two million dollars.

The granite of this State has no superior, if it has an equal. If the present rate of increase continues Vermont will soon lead in this as well as in marble. Six hundred thousand dollars capital is invested, about fifteen hundred men are employed, receiving in wages and salaries five hundred thousand dollars. The out-put for 1889 was five hundred thousand cubic feet, valued at nearly one million dollars.

The slate industry is also rapidly developing. It has a capital invested of five hundred thousand dollars ; employs about one thousand men, paying them in wages and salaries about four hundred thousand dollars. The out-put for 1889 was one hundred and fifty thousand squares of roofing slate and one million five hundred thousand square feet of milling stock, valued at six hundred thousand dollars.

Besides these larger industries there is successful mining of copper, iron and other minerals, and quarrying of soapstone, talc, and other stone. On every hand are great stores of mineral wealth, but waiting for brains and capital to bring it forth.

GEO. W. PERRY, State Geologist.

## A VERMONTER IN DAKOTA.

---

I left the green hills of Vermont  
A year ago last Spring,  
I had saved a little money,  
And I thought 'twould be the thing  
To go out West and buy a farm,  
And work with might and main,  
Get rich as Gould or Vanderbilt,  
And then come back again.

And now I'm back in old Vermont.  
I've learned a lesson, too.  
I cannot tell you half the ills  
And troubles I've been through.  
My pocket-book is empty,  
And I haven't got a thing  
To show for all I've suffered since  
A year ago last Spring.

I had read about Dakota,  
With its mighty fields of grain,  
And of the balmy zephyrs  
That were wafted o'er its plains;  
About its gentle showers,  
And pleasant falls of snow,  
And therefore to Dakota  
I made up my mind to go.

I bought a farm and built a house,  
I sowed my fields with grain,  
And waited for the zephyrs  
And the gentle falls of rain.  
I did not have to wait in vain,  
For on one summer day  
There came a gentle zephyr  
And blew my house away.

I watched my fields of growing grain,  
And figured o'er and o'er  
The bounteous gain that I should have,  
A hundred fold or more ;  
The gold for which I'd sell my grain,  
The mortgage I would pay.  
Alas ! the "hoppergrasses" came  
And carried it away.

The chills and fever then jumped in  
And stayed with me till fall ;  
Then shortly Mr. Blizzard came  
And made a friendly call.  
He brought those pleasant falls of snow,  
And kindly buried me  
So deep that, for a week or more,  
The sun I did not see.

Before the dreary winter passed  
I nearly starved to death,  
And in the Spring I gathered up  
What few things I had left,  
And so, by working on the way,  
At last, worn out and gaunt,  
I found myself once more, thank God !  
Again in old Vermont.

That farm is in the same old place,  
If it hasn't blown away,  
And anyone can have it  
If the mortgage they will pay.  
But to the young men of Vermont  
My kind advice would be :  
Stick to the green New England hills ;  
They're good enough for me.

*H. W. Stocker in Boston Globe.*



## SUMMER RESORTS.

---

To specify each locality in Vermont possessing attractions to the summer tourist, or inducements to one wishing to build a summer home, would require nearly a complete description of each town. It may be truly claimed that hardly a town is without some advantage that would entitle it to be mentioned. This follows from the fact that the attractions of Vermont are of a varied character.

To the sportsman, the wilderness filled with an abundance of the smaller game animals, would be the attraction. The fisherman would find his enjoyment on the beautiful lakes or ponds, or in following a portion of the thousands of miles of brook and river in pursuit of the fish which there abound, the most plentiful and gamiest of which is the speckled trout. To one seeking rest and relaxation from the strain of business cares, no more perfect quiet and restful surroundings can be found than in the country towns among the farming population, many of whom are prepared to entertain. To persons seeking simply pleasure, we recommend Vermont for the fine boating upon its ponds and lakes, for the fine drives along the valleys, and for the congenial companionship to be found at the summer resorts. Seekers after health are invited to try the effect of the pure water, the clear, fresh, invigorating air of our mountain towns. It has often succeeded where medicines have failed. And especially do we ask for Vermont the attention of students and lovers of nature in all her varying moods. The height of our mountains is exceeded by many localities, but their beauty by none, clad in green to their greatest altitude, clustered together without system or order, but in great harmony, tinted with varying hues and shades by the foliage of the forests at the different altitudes, they possess a charm and beauty peculiarly their own, and sufficient to have called visitors year after year to return to enjoy them. The landscape views, like the mountain scenery, is of great variety and always beautiful. As seen from

the mountain summits, there is the cultivated farm, the country hamlet, with its single church spire and country store ; the manufacturing town, with the smoke from its many chimneys ; the ponds and lakes nestled among the hills and mountains ; the stretch of river glistening in the sunlight, and a grand panorama of hills, mountains and valleys extending in all directions, combining to produce a scene of rare beauty and interest, which it is an ever increasing delight to study.

The following description of Vermont scenery, taken from the advertisement of the Woodstock Inn, does not more than tell the truth :

“It has not until recently been known that Vermont offers more beautiful and restful retreats for those who seek a refuge from the summer heat and dust of the city than does any other part of New England.

“In their rush for Saratoga and the White Mountains, summer visitors have formerly overlooked the charms of the Green Mountain State, but now it is beginning to be known that in her dark wooded valleys and by her winding rivers, and on her smooth mountain tops are to be found many spots of surpassing loveliness.

“The charm of Vermont scenery is like that of a beautiful face, of which one never tires. The loveliness of a June day in a Vermont valley would bring a new sense of life to any one who had never before experienced it, while the October glories which settle over her hills can no where be matched in all our land.

“Vermonters are learning that scenery has economic value, and urbans of wealth are gaining footholds all over the fair domain. No one of taste and travel can journey through the State without accepting as literally true the beautiful word picture of the late Rev. Dr. Wm. H. Lord, who, after making the tour of Europe, wrote as follows :

“ ‘A few regions God has made more beautiful than others. His hand has fashioned some dreams or symbols of heaven in certain landscapes of earth : and we have always thought that the Almighty intended when he formed the hills of Vermont and shook out the green drapery of the forests over their sloping shoulders,

and made them fall in folds like the robe of a king along their sides, to give us a dim picture of the new creation and the celestial realm. Italy is a land of fairer sunsets and deeper sky, of haunting songs and grander memories ; Switzerland is a region of more towering sublimity and unapproachable grandeur ; but in all the galleries of God there is none that so shows the exquisite genius of creative art, the blending of all that is beautiful and attractive with nothing to terrify the eye, the mingling of so much of the material glory, both of the earth and the heavens, with so little to appal the sense. Vermont in summer is the Almighty's noblest gallery of divine art.'"

Without attempting to indicate the localities of greatest interest in the State, it may perhaps be said, in general terms, that the favorite region for the sportsmen and fishermen is in Essex and Orleans Counties, as the great extent of wilderness and numberless lakes, ponds and streams of this section abound in fish and game. Along the shore of Lake Champlain and on the islands composing Grand Isle County, is found the favorite resort for summer camping parties, and many fine residences have been built in this section for summer homes by men of wealth. A large part of the town of Shelburne has recently been purchased by Dr. W. Seward Webb, who is expending a large sum of money in beautifying and fitting the grounds to his taste. In the southern portion of the State, in the vicinity of Readsboro and Wilmington, is some grand and imposing mountain scenery, while along the range of the Green Mountains, Mt. Mansfield, Camel's Hump, Killington and Ascutney, are noted the world over for their grandeur and beauty, and for the unsurpassed views from their summits. Of the view from Mt. Mansfield, a writer has said :

"From the Chin the spectator has one of the most comprehensive, variegated and beautiful views to be found in all New England. Toward the west, the eye, starting from the base of the mountain, runs over the Winooski Valley, threaded by roads and streams, and dotted with countless white villages, the effect of which is both remarkable and pleasing ; takes in Lake Champlain, which on a clear day can be seen for nearly its entire length, and is arrested only by the Adirondacks in the remote horizon. On the

north the outlook is even more extensive, and at rare intervals, under peculiarly favorable atmospheric conditions, even includes the spires and towers of Montreal, one hundred miles distant. Directly beneath and between the first and second chains, lies the Lake of the Clouds; lower down the dark recesses of the Smuggler's Notch, and across this the Sterling Mountains. Moving to the east, the eye falls upon a succession of dark and heavy ridges, thickly wooded, giving and receiving shadows in endless variety; farther away, the valley of the Connecticut; and beyond, the White Mountains, Mount Washington itself being sometimes seen, though indistinctly. The picture is completed by Stowe and its neighbors, nestling in the rich valley, and directly south the rival peak of Camel's Hump and the main chain of the Green Mountains. Such is, in general, the scope of the view afforded from Mount Mansfield. The countless details which give it grace, picturesque and value cannot even be enumerated, but must be left with the assurance that not one which the imagination could crave will be found wanting by the most exacting lover of nature."

Cheap lands, admirably adapted for building summer homes, are to be found in nearly every County, and many people of limited means are finding that in providing these homes, their families may enjoy the advantages of a summer in the country, and return rich in renewed strength and health, and at less expense than they could have remained in the city, the difference in cost of living being more than sufficient to pay all traveling expenses.

## VERMONT MANUFACTURES.

---

### MARBLE.

The manufacturing industries of the State are few, and yet there are some of such magnitude and reputation as to clearly demonstrate the fact that, if the Vermont capital that has been so freely sent to the West, could be utilized to develop the natural possibilities of the State, every one of her many unused water powers would soon be the center of a growing manufactory.

At the present time the largest single industry in the State is the quarrying, sawing and finishing of marble, several million dollars of capital being invested in it; and while it is a large State industry, it gives Vermont prominence among other States, the last census bulletin showing that of all marble produced, for whatever purpose, in the United States, Vermont furnished more than 62 per cent, and of the marble used for monumental purposes, it is probably a conservative estimate to say that at least 90 per cent is quarried among our Green Mountain hills.

Although the deposit is found cropping out throughout the State, it is only in a comparatively small part of it—Rutland County—that the most valuable quarries are found. In the north, at Swanton, a very fine hard grained, colored marble is produced, that is used very largely for interior work, and in Bennington County a coarser grained marble is quarried, suitable principally for building purposes. The centers of the industry, however, are at Proctor, at which place the celebrated Sutherland Falls and Mountain Dark Marbles are quarried, and at West Rutland, at which place are located all the quarries of the Rutland Marble Company.

While marble was found in the State in the early part of the present century, its consumption for many years was limited to the taking out of slabs in a rough way for home use. Until railroads were built in the State, a small trade was carried on by teaming the stock to Whitehall for shipment by canal. The introduction

of railroads gradually led to an increase in quarrying, but it is not more than twenty years ago that the business began to show that development which has since placed it among the foremost industries of the country.

#### GRANITE.

Next to marble, the production of granite takes its place as an important industry to the State. Its production is of recent date, and the growth and success of the business has been almost phenomenal. A few years ago a single firm undertook to quarry granite at Barre, believing that the stone there was of good quality. The success of the effort is witnessed in the growth and extension of the business. To-day over thirty companies are engaged in quarrying granite at Barre. The industry has spread to other towns, notably Hardwick, Williamstown, Dummerston, Berlin, Woodbury and Ryegate. The excellence of Vermont granite has obtained for it a national reputation, and a ready market, and at no distant day it is likely to lead every other State, as well as to become the leading industry of this State, if its present rapid increase of production continues. The supply of granite is practically unlimited, and the many new quarries opened in new localities this season will add largely to the output. At the present time there are nearly a million dollars of capital invested in this business, about 2,000 men employed with wages and salaries of over \$500,000. For 1889 the output was 500,000 cubic feet, valued at \$1,000,000. No business in the State employs so much help for the capital invested, as the granite industry. As the center of marble industry is at Proctor, so is the center of the granite industry at Barre, and the growth of Barre in the past ten years, from a farming township with a small village containing altogether in 1880 a population of 2,060, to a manufacturing town of 6,812 persons in 1890, is evidence both of the rapid extension of the business and of the benefit of such industries to a locality.

#### SLATE.

The quarrying and manufacture of slate is an important Vermont industry, and competes closely with its granite and marble.

The main product is in Rutland County, in the towns of Poultney and Fair Haven. Other localities do something in this direction, especially the towns of Castleton, Pawlet and Northfield. Nearly fifty companies are now engaged in this industry, with a capital invested of \$1,300,000, and were employing in 1889 over 1,300 persons, paying in salaries and wages yearly about \$500,000. The output in 1889 was 150,000 squares of roofing slate, and 1,500,000 square feet of milling stock, valued at about \$600,000. Vermont produces about one-fifth of all the slate in the United States, no state except Pennsylvania producing as much.

#### OTHER MINERAL PRODUCTS

Copper has been largely produced in Vershire and some other towns. Iron, talc, soapstone, freestone and asbestos are all worked to a greater or less extent. The very general success which has come from quarrying and mining gives great encouragement for the future. That the mountains of Vermont are filled with valuable products is a reasonable conclusion, and it may easily be true that the unseen and unknown wealth which is there concealed, exceeds in value all that has ever been produced in the State.

#### DEPOSITS OF SERPENTINE AND SOAPSTONE.

In the eastern part of the town of Ludlow and western part of Cavendish, are extensive deposits of serpentine and soapstone. About fifty years ago the serpentine was worked in a small way for a short time. It proved to be of fine color and took a high polish. Later some work was done in getting out the soapstone, but at present nothing is being done with either.

Copper has also been found in this same locality, cropping out in several places and the indications are that there is an extensive deposit of easy access.

Recently there was a little prospecting in town by a gentleman from Asbestos Mines, Canada, and it is understood that gold was found in several forms.

---

CREAMERIES.

The introduction of creameries in the State has made rapid progress in the past two or three years, and a large per cent of the milk of the State is now handled by them, adding thereby to the value obtained from the milk, and lessening in a large degree the work of the household. Their further introduction is simply a matter of time.

At St. Albans is located the Franklin County creamery, said to be the largest creamery in the world. It has been operated only one season and has not yet reached its maximum capacity. This mammoth creamery is supplied by separators located in nearly every town in Franklin County, at convenient points along the different lines of railroad, the cream being shipped by special cars to the factory. About fifty separators are at present being operated by this company.

## WOOD.

The manufacture of wood in its various forms is an important industry in Vermont. About seven hundred mills of varying capacity are engaged in this work, employing some three thousand persons. Capital is invested to the amount of nearly four million dollars, and an annual product of about three and one-half million dollars is produced.

## WOOLEN FACTORIES.

About forty woollen mills are reported for Vermont, employing about two thousand persons, and having over two million dollars invested as capital, and paying out annually about one-half million dollars in salaries and wages.



## BUSINESS OPPORTUNITIES.

---

### UNDEVELOPED OR UNUSED WATER POWERS.

At Vergennes, Middlebury, Readsboro, Searsburgh, Essex, Fairfax, Georgia, Johnson, Windsor, Hartland, and Middlesex, very extensive water powers are reported, varying in capacity from 300 to 3,000 horse power, several claiming to be the best in the State. From the towns of Weybridge, New Haven, Manchester, Ryegate, Shelburne, Brunswick, Enosburgh, Montgomery, Morris-town, Bradford, Stockbridge, Pittsford, Wilmington, Halifax, Whitingham, Cavendish, Sharon, Springfield, and Woodstock, large powers are reported with capacity from 100 to 300 horse power. The smaller powers, ranging from 30 to 100 horse power, are in the towns of Ripton, Bristol, Sutherland, Landgrove, Shaftsbury, Waterford, Barnet, Wheelock, Orange, Thetford, Newbury, Brookfield, Troy, Greensboro, Westmore, Charleston, Mount Holly, Sudbury, Mendon, West Haven, Fair Haven, Northfield, Marshfield, Milton, Jericho, East Haven, Elmore, Stowe, Wolcott, Guilford, Somerset, Jamaica, Norwich, Bridgewater, Tunbridge, and West Windsor. Our inquiries did not include the small and irregular powers, but only such as were reliable through the year, and suitable to use for manufacturing purposes.

### UNDEVELOPED GRANITE.

Quarries of this stone which have been tested and found of good quality, but not worked extensively, are reported from the towns of Ryegate, Brunswick, Morgan, Newark and Windsor. Very extensive deposits, of which the quality is not known or stated, are in the towns of Orange, Braintree, Tunbridge and Weathersfield, and quarries or deposits are found in Sheffield, East Haven, Concord, Victory, Vershire, Topsham, Ira, Poultney, Northfield, Marshfield, Woodbury, Plainfield, Dummerston, Sharon and Bethel.

---

MARBLE.

The towns reporting a fine quality and large amount of marble are Manchester, Shelburne, Highgate, Windsor, Proctor and West Rutland. Orwell reports both black and white marble, Fair Haven the abandoned Valiedo marble works and the towns of Middlebury, Bridport, Monkton, Bristol, Hinesburgh, Georgia, Danby, Sudbury, Pittsford, Ira, Roxbury and Plymouth all report quarries that have been worked, some doing a small business now, but many and most of which for one reason or another have been abandoned. In most cases the marble is said to have been of good quality. Deposits of marble are also found in the towns of Somerset, Jamaica and Tinmouth.

## SLATE.

Slate quarries are found in the towns of Orwell, Waterford, Highgate, Georgia, South Hero, Fair Haven, Poultney, Benson, Montpelier, Northfield, Putney and Springfield. Very many of these quarries are not now operating, but no reasons are assigned. Deposits of slate are also found in Wells, Pawlet, Guilford and Dummerston.

## UNDEVELOPED MINES, ORES, ETC.

Iron ore is found in the towns of Searsburgh, Sandgate, Enosburgh, Elmore, Troy and Tinmouth. Some of it has been worked to a limited extent, and found to be of good quality.

Copper mines are found in Westford, Corinth, Vershire, and Waterbury. Some have been extensively worked in the past, but at the present time comparatively little is being done. Copper deposits are also reported from Topsham, Fairfax, Cavendish and Searsburgh.

Lead is found in Searsburgh and Elmore.

Quartz at Sheffield.

Asbestos in Lowell.

Soapstone quarries in Stockbridge, Cavendish, Chester, Windham, Townsend, Moretown and Bakersfield. Scythe stone ledge in Williamstown, Gayssville; freestone in Belvidere.

## ADDRESSES BY INVITED PARTIES.

---

### POULTRY ON THE FARM.

Read by MR. GEO. H. NORTHRUP of Raceville, at the Fairhaven Meeting.

There is no source of profit, available to the farmer, which is capable of giving so large returns for the amount invested as poultry. For example, a dozen of eggs can be produced at less cost than a pound of pork. It is a well known fact that the farmer receives 30 cents per dozen for all the eggs he has to sell as often as the choicest bit of pork reaches 15 cents per pound. And while the price for a dozen of eggs seldom falls below 10 cents, the price of pork often declines to 5 cents per pound. One dozen of eggs, also, cost the farmer less to produce them, than a pound of butter; and we can easily compare the price. At the present time there is more profit in eggs than in raising poultry for market, and yet a pound of poultry flesh can be raised as cheaply as any kind of meat, and it averages double the price of beef or pork to the producer. The house room, made comfortable, and fully equipped for one dozen hens costs no more than the shelter for a single horse or cow. Again, crops that drain our lands of their goodness sometimes fail to give satisfactory returns. A flock of well managed poultry, besides giving a direct profit, adequate to place the industry connected with them above others of its class, furnishes a fertilizer which is almost invaluable to restore our lands to their original fertility. Fowls are the best economizers on the farm, for they pick up every stray crumb, and many kernels of scattered grain that unavoidably fall to the ground and would otherwise be lost. They destroy myriads of insect pests, thus while protecting our crops from destruction, they utilize the destroyer.

The turkey, duck and goose are all valuable to the farmer, but I propose to leave them to consider the hen as the most important

and the one most extensively bred. However, much that can be said of hens will apply equally well to other fowls.

The products of the poultry yard are among the luxuries which are within the farmer's reach, not, however, without effort or expense. Whatever is really worth having costs an effort to obtain. Too much has often been expected from the hens considering the care that is given them, for many a poor biddy is compelled to face the cold winds of winter nights roosting on fences or in tree-tops while many more, a little more fortunate, have only the shelter of an open shed, and are compelled to subsist most of the year on such scattering crumbs and kernels as they can find for themselves, and because their owner is obliged to feed them through the winter only enough to prevent starvation, he complains that they are an unprofitable expense. Now if these same hens had been properly housed, and a little extra care and feed given them the expense they caused would have become a paying investment ; and that portion of their food which must be consumed in keeping them warm could have been used for producing eggs.

So delicate and nourishing an article of food as the egg, is well worth all it costs and it is just as easy to have hens lay at any time of the year as to have cows give milk. There is no luck or chance about it. It is natural for hens to produce eggs, and under favorable circumstances they will lay. It is reasonable to suppose that all who keep fowls for profit want them to lay well, and the next question that interests us is : How to get the most eggs with the least trouble and expense. A building to be occupied by fowls should be made as tight as possible. The warmer it can be made without artificial heat the better.

So many fowls must not be in one apartment that they cannot exercise freely. If the poultry house can be adjoining or accessible to an open shed for a winter run, so much the better. And let the yards be as large as possible for summer. Poultry houses require enough windows to make the rooms agreeably light, but the whole side of glass, which has been the prevailing fashion, is objectionable on account of the cold that it admits. A mistake that is often made in regard to windows, is placing them too high above the floor. Ten inches above the floor is high enough. When

higher, the sunlight, which they admit, strikes the floor far back in the room, if at all, so that it is not possible for the fowls to receive the benefit from it, which they require to keep them in a laying condition.

It has been said, and wisely, too, that "*There is as much in the feed as in the breed.*" But the phrase has been so often repeated that some seem to have decided that "*there is more in the feed than in the breed.*" My opinion is that the saying is better reversed than intensified, therefore, I assume: *There is as much in the breed as in the feed.* However, as I have much to say of the breeds, I will consider feed first.

It is a self-evident fact that hens cannot live without eating, and equally true, that, if they eat only enough to sustain life they cannot produce eggs. There are several classes of substances which are necessary to life including those which are capable of forming bone and muscle and those that furnish the body with fat and consequently heat. Neither one of the required ingredients of food is sufficient when used alone. The experiment has been tried of feeding animals on food containing only sugar and starch, and although such food is relished for a time, the animals soon become feeble and emaciated, and finally die of imperfect nutrition, or partial starvation. A diet composed exclusively of fatty substances is equally incapable of supporting life, and the same is true of albuminous matters. These last substances are usually considered more nutritious than the others but this is simply because they are required in greater quantities since they form so large a proportion of the animal tissues. The albuminous matters alone are not more capable of sustaining life independently than starch or oil.

The white of the egg is composed of four-fifths water. The remaining one-fifth is nearly all pure albumen. The yolk is more than one-half water and has nearly as large a percentage of albumen as the white. It also contains some oily matter, but this forms only a small part of the entire egg, showing that very little fat forming food is required for egg-production. Thus we find that a variety of food is necessary, and as hens in confinement are deprived of all opportunities to supply themselves with the vari-

ous elements they require, we must provide them. For morning feed, grain in the following proportions ground together is excellent: corn 2 bushels, wheat 2 bushels, oats 1 bushel, barley 1 bushel, buckwheat  $\frac{1}{2}$  bushel, and 1 peck of peas; to which add 1 pound of lean beef scraps and a little good egg-food (*not condition powders*), for every 20 hens. Wet the mixture with hot skimmed milk or water until you have a crumbly mass and feed only as much as they will eat up clean at one time. Fowls need exercise to keep them healthy, and if somewhat hungry, after finishing their breakfast, they can be kept busy all day scratching for wheat and oats which has been scattered in straw on the floor for this purpose. At night feed all the corn they will eat, just before going to roost.

Plenty of fresh clean water is equally as essential as food. In winter it should be slightly warmed. The best and cheapest dishes to use for watering hens, are stoneware drinking fountains, made expressly for this purpose. They are inexpensive and will last a lifetime. They keep the water clean. They will not tip over, and hens cannot stand in them. These same fountains are excellent for young chickens, as they cannot get in them and drown. They greatly help to prevent gaps and cholera by keeping the water clean and healthy.

Now in regard to breeds, of course mongrels are cheaper to begin with than thorough-breds, but we may seek in vain for any other advantage. They comprise all sizes, shapes, colors and kinds. They cannot be assorted or bred for any purpose, and while one flock may be profitable another may be almost worthless; one hen in a flock may thrive, while another will pine under similar treatment, so very different are their characteristics and their requirements.

With the thorough-breds it is different. We can have a whole flock alike and they will all thrive under the same treatment. We can select a color according to our taste from modest gray to the most gorgeous combination of hues. We can breed for eggs or flesh, for sitters or non-sitters, for large or small fowls. We can choose a breed whose eggs will be either white, buff,

brown, large or small. And we can be certain that the offspring will be like their ancestors.

Some farmers think they cannot afford to keep thoroughbred fowls, but it is difficult to see how they can afford to do otherwise when a flock can be started so cheaply. Fowls are so prolific that one can soon raise a large flock with only a few to start from. Suppose a setting of eggs costs \$3.00. It is reasonable to expect as many as six chickens from them, in which case they will have cost only 50 cents each, besides the care given them. Even a mongrel flock of hens can be graded up and greatly improved from breeding from a thoroughbred male of the desired kind each year. The American Poultry Association have included seventy kinds of hens and described them separately in their "Standard of Perfection" and there are several other recognized varieties, each of which differs from the others in one or more respects. With so many to select from anyone can easily find a breed that will meet his requirements. If he makes a wise selection the fowls will meet his wants and he can depend upon them for uniformity of appearance.

Whatever is the object of keeping fowls the breed should be selected with reference to it. For instance, if a large, matured fowl for market be the object we cannot do better than to select a Bramah or Cochin but it is useless to expect them to be profitable egg-producers. If we want fowls that are fair layers, good mothers, and the best for broilers we can do no better than to choose Plymouth Rocks or Wyandottes. The Leghorn, Polish and Hamburgh are among the most beautiful varieties. They are very good layers of small eggs, and where a large number of eggs are wanted without regard to size, they have no superiors: but being small they are not of much account for table use. The Black Minorcas lay the largest eggs of any hens known and more in number. Their flesh is delicious for food and their bodies being large makes them a very desirable table fowl.

Perhaps I cannot better illustrate the advantage of having thorough-bred fowls than to relate my own experience of the present winter. I have sold about 150 dozen of Black Minorca eggs at 5 cents per dozen above the market price. An advance of more than seven dollars above what common eggs would have brought

to say nothing of the many dozens, I have gained by having an egg-producing variety, and nearly all were sold to customers who were so anxious for them that they came to my place to buy them.

The large size of Black Minorca eggs make them actually worth more than common eggs. Two of them are equal to three of the ordinary size for all culinary purposes.

As a closing point let us notice that the poultry industry is not likely to be over-done. The supply of either poultry or eggs is not equal to the demand. The fact that millions of dozens of eggs are annually imported into the United States must have been the reason for the "five cents a dozen" clause in the McKinley Bill.

With the present demand it behooves the farmer to feed and breed for a purpose whether it be for eggs, broilers, or poultry, and to sell as much as possible direct to the consumer. By selling a superior quality one can command a higher price which will not be affected by the fluctuations of the market. People can afford to pay extra prices for what they know to be good, and many would use much more of both poultry and eggs if they could be sure of getting a superior article, hence we can increase the demand and price by improving the quality.



## A FEW THOUGHTS SUGGESTED BY THE TIMES.

---

Read at the Brookfield meeting by LUNA S. PECK.

We are well aware that those who are engaged in farming in Vermont at the present time, labor under a combination of circumstances disadvantageous to the accumulation of capital. Is the primary fault in our farms? Has our native soil so degenerated since our fathers tilled, that under judicious management it will not yield a profitable return? Why is it, that in taking a carriage drive, either east or west, north or south we note a dozen or more deserted farm houses, with the sign "For Sale" hung out as a forlorn hope. Many of these places were once our most thrifty farms as the substantial bars and other buildings will testify. Have the owners emigrated to the far west or to the populous cities of the east, or have they located in the business centers of the State. In either case, a feeling of dissatisfaction with the returns of their labor impelled their removal. The fact is only too apparent that sections off the line of the railroads are being slowly but surely depopulated. It may be suggested that the farmer's expenses for living are seriously larger as compared with former generations, but, let me ask, has the farmer's increase in expensive habits been proportionately greater than the increase of like expenses with the manufacturer, the mechanic, or in all the multitudinous forms of trade that exist within our centers? Does the farmer's wife dress any better or employ any more help than other women whose husbands have a like amount of capital invested in other business? Are his children any more expensively educated? Do you say that the farmer shall not have any more advantages than his father had, and that somehow, or somehow the other occupations shall absorb all the benefits that accrue from his labor? But, you say, the other occupations are able to pay for the advantages; granted, and that brings us back to the starting point; why is not the farmer able?

Let us consider the subject of taxation, for here I think lies a large root of the evil. In many cases farms are appraised for more

than they will sell for in the present depreciation of real estate, the occupant must pay taxes on the full appraisal whether he owns one-half, one-third, or not one dollar in the form of which he holds the deed. Large appropriations for extravagance in high places, increase of salaries etc., etc., are decreed by the powers that be, to be paid largely upon real estate by men who are only the nominal owners. Is not what is known as "double taxation" as unjust as "taxation without representation?" If so, then woman with no voice or vote, save to pay her taxes when they are demanded, stands not alone, but the poor man compelled to pay taxes upon property that he does not own, and never may, will bear her company.

Next in importance is the question of help. Our young men and women flock to the cities hoping for lighter work and fewer hours, thus producing a great scarcity. We must pay \$20 or more per month, and \$2.50 or \$3.00 per week for the same class of help that fifty years ago could be procured for \$12 per month and 75 cents per week.

A few years ago the Vermont farmers yielded largely to the temptation of buying western corn. They said "it is cheaper to buy corn than to raise it," but they soon found that if it was cheaper it did not "materialize" sufficiently to pay for the corn and leave a balance in the treasury. Phosphates were then placed upon the market and printer's ink spread thick and thin upon reams of paper and webs of cotton, advertising this, that or the other brand, with all the magnificence and grand eloquence of a third rate circus. The end of it is not yet, but if you will permit I will venture the prediction that a fertilizer that contains the elements of permanence will be demanded in the near future, that the expensive fertilizers that produce no perceptible result after the first year will be compelled to give place to some combination that will not only feed the first crop, but also enrich the soil for the second and third. The great producing centers of the west have kept an iron finger upon the pulse of our eastern market. Beef and pork for the past few years have scarcely paid the cost of production. Poultry for some time a paying branch died the death of the overdone in the fall of '85. Butter yet staggers under the blow dealt by the manufacture of oleomargarine, and the farmers find that after

paying extortionate freight and commission rates his net receipts are shadowy. The farmer generally speaking is a peace-loving, God-fearing inhabitant from his constant association with nature in all the varying moods of changing seasons, the grand and solemn silence of the dim forest, the open field, fragrant with breath of herb and wild flower, and vocal with song of bee and bird, and hum of insect life. Indeed, every outward influence tends to turn his mind from the hatreds and broils incident to metropolitan labor, and in its ennobling influence "lead him from nature up to nature's God." If, for these and kindred reasons you claim that farmers have no need to organize, I shall beg leave to differ, since he not only needs the mental stimulus of social life which well-appointed organization insures, but he needs also the power that comes with the strength of numbers, to secure his own inalienable rights against the massed force of organized labor upon one hand and the trusts, monopolies, and corporations of massed capital upon the other.

"Organizations to right of him,  
Organizations to left of him,  
Organizations in front of him,  
Volley and thunder."

And do you bid him fold his arms, and cast no backward shot until his own claims and the claims of his industry are shelled out of existence?

But you say, "I do not believe in secret societies." Have you ever known a secular organization that could exist without the safe guards that secrecy imposes.

Have you ever known a farmer's club that did not die an easy death? Have you any time or ability to draft a form that will admit every one regardless? What are the probabilities that such an organization would prove a success? What would you have said if, in our civil war, that vast volunteer army had been sent to southern battle fields, every man for himself, no companies or captains, no regiments or colonels, no brigades or generals, and over and above all, no commander-in-chief? Would you not have said in strong language, that such stupidity deserved defeat? Thus, to-day, when all the world is organized, the farmer has vital

---

need of the subordinate organization, as a stepping stone to state organization, which in turn reaches the national organization and the system is complete.

Vermont with unrivalled scenery her clear bracing air, and pure water has well been termed the Switzerland of America. Let us therefore as true sons and daughters, proud of her past achievements take no backward step in the "forward march" of true progress.

## DEHORNING CATTLE.

---

Read at the Springfield Institute by JAMES R. WALKER.

Self preservation is the first law of nature. From man down to the lowest animal, all have some means provided by their Creator for their defense and preservation. Some have slight means, and more easily fall victims to their powerful enemies; others are preserved by the immensity of their numbers. The birds protect themselves by the use of their wings, animals by great power of speed, beasts of prey by powerful claws and teeth. The bovine family use their horns as weapons of offensive and defensive warfare. In their wild state and in countries where they might be destroyed by beasts of prey, their horns are of great service to them, but in civilized communities where the cow has come to be quite an artificial production, the need of their horns is less apparent. Those persons who have been fortunate enough to breed polled cattle never regret the absence of horns.

Cattle with horns know their power and use it cruelly, with seeming pleasure. They exhibit the symptoms of total depravity. So well do they use these weapons that a gentleman of extensive observation and experience in the cattle business, estimates that more than 200 lives are lost annually by horns in the United States, and that 100,000 cattle and horses to say nothing of sheep and hogs, are yearly destroyed by the same cause. Much of the loss of calves by abortion is caused by the improper use of horns, and heavy losses in shipping result from the same cause. The underlings of a herd are frequently set upon by the more powerful animals, and if not killed, are so frightfully gored as to destroy their future usefulness.

What the advantages of horns are, I am unable to state. From my standpoint I can see no earthly use of horns on cattle. If enough polled cattle could be bred to take the place of horned ones there are very few persons who would not prefer them. This cannot be done at once, as there are so few to breed

from. But we can have artificial mullies at once by dehorning our present stock, and thus have the advantage of polled stock with little trouble and expense. "But," says one, "does it not hurt cattle to saw their horns off?" Yes, it undoubtedly does hurt some. But judging from the action of the animals it is not so painful as castration or spaying which is performed on horses and cattle by stockmen the world over.

For nearly twenty years editors and correspondents of Agricultural newspapers have spoken in high terms of the hornless herds of cattle, and many readers have been educated to desire to have their herds without these useless and dangerous appendages, but with so few pure bred polls it has been slow work getting the horns off by breeding alone. Sawing off horns from steers to be fed for beef has long been a common custom in certain localities in Ireland, but not till within a few years has the custom received much attention in the United States. Since the polled Angus cattle have been introduced upon the ranches, stockmen have found that polled cattle have many advantages. They are more quiet, may be housed or yarded safely in closer quarters, and can be transported in cars with much less risk.

Mr. H. H. Haarf, an extensive cattle feeder in Illinois, was one of the first men in this country to advocate and practice sawing off horns from beef cattle. He made a few experiments with such excellent results that he soon became an enthusiast on the subject, and has not only taken off large numbers of horns from his own and other's cattle, but has publicly advocated the practice through the agricultural press and books he has published. He was prosecuted in Illinois courts for cruelty to animals, but the evidence was so overwhelming in his favor that he was sustained by judge and jury.

I have dehorned my Jerseys, about twenty animals, and helped to dehorn six other herds, the largest consisting of 55 Holsteins, and no bad effect has followed to a single animal. We are all much pleased with the result and behavior of our cattle. It takes the conceit out of them. They know that their power is gone. It makes them peaceable and gentle. The man-killing bull is shorn of his power. My new milch cows did not shrink in the flow of

milk to any perceptible degree and the springers were not injured by the operation. They will now drink, two or three at once, in a small trough, and huddle together like sheep without the power to injure each other.

At the head of the Holstein herd which I helped to dehorn, stood a famous old bull, a splendid animal. He was worked with a stag continuously, and considered gentle and safe. A few weeks previous the bull had nearly killed his owner and would have done so only an attendant beat off the brute with a pitchfork. The gentleman is not in love with horns. He feeds his stock, without tying, in racks, under sheds and in barn cellars. He says he could not have fed more than one-half as many last winter in a shed, with horns on, as he now can with them off and there is now no danger of goring. I have had the udders of two of my best cows nearly spoiled by another viscious hooking cow.

In describing the manner of dehorning let us first consider the calf. The embryo horn in the calf is a mere button or cartilage, and not attached to the frontal bone till the animal is eight or ten weeks old. Now if this embryo horn is cut around and taken out, and the frontal bone beneath it, which grows to form the bone horn, is gouged off so as to stop such growth, the calf will grow up a mulley. This should be done before the bone horn and shell horn have united. A gouge is made for this purpose, but a good jack-knife, which every Yankee is supposed to carry, will do the work when properly used. Take out a piece of skin with the knife the size of a half dollar, and gouge out the bone horn beneath it, or a stub horn will grow. It will soon heal and no harm will follow. The embryo horn can be killed when the calf is young, by rubbing on caustic potash. Wet the place where the horn is to grow, and rub it thoroughly with a stick of caustic potash; repeat if necessary. H. H. Haarf, Chicago, Ill., sells a liquid which he prepares, that stops the growth of a calf's horn if applied when the calf is young.

In older cattle the saw is used for dehorning. The horn is composed of four parts: the bone horn, the periosteum or membrane around the bone horn, the shell, and the matrix at the base of the shell. The only sensitive part of the horn is the membrane

which surrounds the bone horn. This is supplied to a limited degree, with nerves and blood vessels. It is important to cut out the matrix. If a horn is knocked off or cut in the middle, or an inch from the head, copious bleeding may follow, but if cut at the matrix very little bleeding will usually occur, and it soon stops after turning the animal loose. In most cases the matrix or base of the shell lies back of the edge of the hair  $\frac{1}{4}$  to  $\frac{1}{2}$  of an inch, more in young than in older cattle, so in the operation you will cut off some of the hair. Don't be afraid, you are a long distance from the brain. Cut well down in a gouging manner. Don't let a little blood frighten you. Turn the animal loose as soon as the operation is performed, and the bleeding will soon stop. The horn is hollow after they are a year old, and has neither marrow nor pith. What is usually termed pith is bone horn and is without sensation.

The proper saw to be used is a very narrow one, like a jigger saw  $\frac{1}{4}$  inch wide and 10 to 12 inches long, framed and filed like a butchers saw. A long or wide saw is not suitable.

It is important that the animal be fastened securely before beginning the job. Put the animal in a stanchion. Take a strong rope 15 to 20 feet long, with two rings at one end 2 or 3 inches in diameter. Put the ring end over the animals neck. Take hold of one of the rings below, and double the rope through the ring which forms a loop; draw the loop over the nose. Now put the rope over the top of the stanchion to one side 45 degrees and draw up. One man will raise the head and two draw upon the rope tight; wind the rope and pass it back and through the other ring; put it over the top of the stanchion again and draw the head high up, bind the rope around the bar again and fasten the head as tight as you can. While one holds the rope you examine the horn, and saw it off at the matrix or base of the shell as quick as possible. Not let down the head and bind to the other side and cut off the remaining horn. Let the animal loose and bleeding will soon stop. Put nothing upon the wound. It will soon heal over and hair out in a short time, and you will have a respectable looking imitation mulley, and much cheaper than polled Angus, Suffolk or Gallaways.



## THE GRASS CROP.

---

Read at the Waitsfield Meeting by D. A. KNEELAND.

In some parts of our country cotton is called king, in others, corn wears the crown, but in Vermont, and among stock raisers and dairy men generally, "Grass is King." In the spring, while the farmer is laboriously plowing and preparing his ground, and planting his other crops, his cattle, with no expensive machinery and very little attention, are busily harvesting the first, and in many cases the most profitable crop of the season, the fresh green grass from the hillsides.

And all summer long, while the farmer is fighting weeds by horse-power and man-power, killing cut worms, potato beetles and caterpillars, and trying to place in his corn field a "monster of such hideous mein" that the crows won't use it for a roosting place, his animals are quietly converting the tender green blades into horse-flesh, wool, milk and beef.

And this they do every day and Sunday too, rain or shine, whether the farmer is at home or abroad, sick or well, busy or idle.

When you look for a farm to buy,  
If your business is dairying,  
*Firstly* glance at the *water supply*,  
*Then* at the pasturing.

But many of our pastures have run out, and it is not practicable to renovate a rocky hillside as we do the smoother mow fields by plowing and manuring, and it is doubtful if any kind of top-dressing will pay on worn-out pasture. Even the best of pasture will partially fail, both as to quantity and quality toward the close of the season, and a serious question with many farmers already is this, what is the best and cheapest material with which to patch up and piece out the pasturage. Difference in circumstances will prevent any one plan being universally adopted, but I believe that

in a majority of cases, the answer should be *Grass*. Some will say "feed meal." It may be profitable to do so for a short time each season. If the grass holds out in quantity the lack of quality may be partly balanced by a meal ration, but when the pasture is close fed something else must be found for clear meal or even meal well mixed with hog brakes and spruce bushes will not fill the bill or the milk pail.

Green oats and rye are used to some extent, but the land has to be plowed every year, and a much greater burden can be obtained in a season with two cuttings of grass. It is preferable to corn fodder for feeding green to cows, is easier to raise and easier to harvest. Make the ground rich for grass, cut the first crop early and dry it, then let the cows cut the second crop themselves as far as possible, and when you feed any green fodder in the barn feed grass; something that you can cut with a mower and rake with a horse rake and that will make more butter per square acre than any corn fodder that ever grew. For this purpose or any other the more clover the better. According to the chemist's tables green clover has nearly twice the feeding value that corn fodder has, and I believe as many tons can be raised to the acre. Some will say, "do not feed or cut off the rowen or the land will run out." Of course *very close feeding* will be an injury, but I believe it may be fed as close as a mowing machine will cut it with no injury whatever. If a heavy growth is left on the ground, the next crop will not grow up through it readily, but will be thin and spindling. Then the old sod will be in the way about cutting the hay. It will rot after a while and make fertilizing material, but it is a very expensive way to manure land. We might let all our crops go without harvesting and the soil would maintain its fertility, but where would the poor farmer obtain his potatoes and johnny cake? Feed the land well and then crop it as fast as you can. The crop which takes the most out of the soil in the shortest time may be the best to raise. Don't let your fertilizers go to waste in the soil while waiting for plant roots to find them, but keep a growing crop on the ground as much of the time as possible. For this purpose no crop is equal to grass.

Ere the snow is gone in Spring,  
Grass roots are growing ;  
When the robins southward wing,  
Green is the mowing.

Yes, by all means cut or feed off the rowen, and I beseech you brethren, raise more of it. You don't have to plow and plant in the Spring, and fight weeds and insects all summer for this crop, and there is no crop so cheaply harvested, so easily fed out, and the manure from it handled with so little work as the grass which the cattle eat on the field where it grows. If you have plenty of this crop, don't keep the stock out in cold storms to eat it, and if you have but little feed it only moderately close and then put the stock, in the barn and let it stay there whatever the weather is.

Coarse fodder is by no means to be despised. With plenty of it and plenty of meal, cattle may be wintered with but little hay, but is not more hay and better hay, with less meal, a more natural and healthful ration? And is it not a cheaper one also? I believe it will be found so in practice, and that horse-men and dairymen should take for a motto. "Grass for revenue and coarse fodder for incidental protection." We cannot have pasturage in winter, but let us come as near to it as possible, and whether much meal or little is fed. Whether a silo is used or not, let us plan for a good mow of best quality hay, for a *mainstay*, and how shall we get it? Some will say: "A wet piece for grass," but if very wet I would drain it or let it alone. Good corn land is good enough for grass.

*Very dry* land is not the best for corn. With land as cheap as it is in most parts of Vermont at present, don't buy a wet farm. Small wet places here and there in a field should be drained. Most farmers in this section make grass part of a regular or irregular rotation, and I know of no better way, for although top dressing is good, it is best for a few years only, and then plowing is required to get the best results. Whatever the other crops in the rotation, they should be well cultivated, and the weeds kept down, *for the benefit of the grass*. When a tough piece is to be handled, cultivate more than one season; make it fine and mellow. Some people will rake off a garden with great care, and think that grass will grow anywhere, but any plant will thrive best in a fine

mellow seed bed. I do not recommend commercial fertilizers for grass. Have experimented with a few kinds, and here is a conundrum for a wiser head than mine. If a certain brand of phosphate, applied to corn and potatoes will greatly increase the yield, why will it not help when applied to grass? Plenty of good stable manure well worked into the soil, is good for grass,—and other crops. Shallow plowing is well enough for corn, perhaps even better for wheat, but deepen the furrows for grass and you will never be sorry. With fairly good soil, deep plowing and liberal manuring, you can beat any common kind of a drouth, and get grass in spite of it. Many farmers do not know what grass will do when it has a chance. They turn over worn out sod, apply manure, raise hoed crops one or two years, then seed in the spring with grass and grain, and no more manure lest it make the grain lodge. The hoed crops and grain take the lions share of the manure, the young grass being heavily shaded, is puny and weak. The shade is suddenly removed in the hottest part of the season, and the farmer blames a dry time for his poor catch. If no top-dressing is applied, he will walk disconsolately over the ground two or three years later and declare that it needs plowing badly. A good way is to plow soon after the grass is cut, manure liberally, harrow thoroughly, and sow grass immediately. Some sow turnips with the grass seed; with this I have had no experience. I would sow grain without grass seed, then after harvesting plow and seed down. This sows the seed at or near the time of nature's sowing, and gives a chance for plenty of manure without lodging the grain. This plan gives the young plants a good start before winter, and I think it better than late fall sowing. I know of no better time or place to apply manure than to the grass at seeding time. If these directions are followed you may expect two good crops of hay the first season, and after the first one is cut, don't forget to put on 8 or 10 loads of good manure to the acre. Don't wait until the grass runs out before you top dress. Prevention is better than cure.

Now perhaps some of you will say to me as the trumpet player said to the orchestra leader, "It is very easy to say, 'Play louder,' but where is the wind." It is very simple to write directions for

applying great quantities of manure, but where is it? On a majority of the farms of this valley, the manure that should be applied to grass, is going to waste. One-fourth or more of the fertilizing material that might be saved from the farm animals is wasted. Too little manure is a chronic complaint, and slow to cure. To prescribe for its various forms would make this essay too long, but what makes grass at Mountain Home Farm, is one to two inches deep of muck or dirt in the trenches every time the stables are cleaned, summer or winter.

In smoothing down steep land use a light roller or drag, that will level or crush the higher lumps but leave many small depressions. These will fill with water during a shower and much more of it soak into the land than if it is very hard and smooth.

Now as to varieties, I will only mention those I have had experience with. Timothy or herds grass I need not describe. You all know it, we all sow it. It holds the first place and justly too.

*Save your own seed*, and be sure you have no weed seeds in it; let it get well ripened, and you will have strong plants. Dry the stubble well, and feed it to horses.

Ten quarts of this home-grown seed and ten pounds of red clover to the acre is enough. Some say "Sow a little seed of other kinds to thicken up." Well, if herds grass and clover is best for the main crop, why not use it to thicken with. With above amount of good seed and ground prepared according to the foregoing direction, there will be little room for anything else. Red top is later than herds grass and of smaller growth, it will not start readily after cutting and its general use is not to be recommended.

The same objection and some others may be urged against Kentucky Blue grass, (*Poa Pratensis*), but it is a good pasture grass, and will stand hard treading and close feeding far better than herds grass. White clover is also excellent for pasture, but for hay, red clover is far better than white or alsike, because of its larger growth. Orchard grass (*Dactylis Glomerata*), is the earliest of our common grasses, a little of it scattered in a field is a nuisance, as the stems will get hard and woody almost as soon as the blossom falls, and before other grass is ready to cut, it will be in full blossom by the 15th of June, in an ordinary season. Will

yield as much at first cutting as herdsgrass, and starts quicker after cutting and grows faster, will keep growing later in the fall. If the ground is rich and the first crop taken off early, two more pretty good crops may be cut the same season. But there will be heads on the first crop only. It contains more water than herdsgrass, will shrink more in drying, will yield more per acre in the entire season than any other grass. Cattle eat the hay greedily, it has a better nutritive ratio than herds grass and I believe it is fully equal to its feeding value.

Mr. A. W. Cheever of the *New England Farmer*, calls orchard grass rowen "The perfection of dairy fodder." Before saying amen to his statement, I would wish to amend by adding to the perfect fodder a liberal sprinkling of clover. Orchard grass is said to winter-kill easier than herdsgrass, but I have never seen it killed except in low places where sheets of ice had formed.

Cattle in fall feed will eat every thing else first leaving the edge of the orchard grass looking as if a mowing machine had been run alongside. Then some fine morning you will see them all in the tall grass which fast disappears. On a large farm I would sow a few acres of it to cut before the main crop is ready. The seed is coarse, resembling small oats, and two bushels per acre should be sown. I consider clover one of the best things a farmer can raise; always sow it when you sow grass. Being a biennial plant it will soon disappear, and after studying on this awhile I tried an experiment to see if I could make it stay longer on a piece that was top-dressed in the fall. I sowed clover seed in the spring and bushed it in, considerable of it grew, and I think the hay will be enough better to pay for the seed, and I bush the ground in spring whether clover is sown or not. Clover will sometimes winter kill if sown late in the fall. It may be sown with good results on a light snow in the spring. As to time of cutting we all know that early cut hay is best. It is very seldom that a man gets through haying so early that he is sorry to be done.

If there are any needed repairs for the mowing machine see to it just as you are through using it for the season, you will have as much time then as ever, and will remember what it needs; if you

have to send to the factory for anything it will just about arrive in time for next haying, and by working hard all winter you may get money to pay for it. Don't tinker up an old good for nothing scythe for the boy. Give him as good as there is, he will need it then if ever. Don't be mending tools when it is fair weather if you can help it. When there comes a rainy day grind up all the scythes, mend the rakes, level down the hay mow if it needs it, and get all ready for a hay day. Do this even if you don't go to the village till the next rainy day. Deep bays to drop hay into will save much work if no horse fork is used. Nothing is better to draw hay on than the old fashioned ox cart; if you don't keep oxen make a wagon rack as near like the ox hay rig as possible. Don't watch the weather too much, when it looks fairly favorable, mow. I don't believe it pays to cock up hay just too keep the dew off it, unless it is dry enough to cart without opening. Never cock up *very* green grass. It will blacken if it stands long, and won't hurt much for a day or two if spread out. If *two-thirds* cured however it may stand several days, rain or shine, without much danger, and such hay will be enough better off in rainy weather to pay twice over for cocking up. Have never used hay caps, don't believe they would pay.

If the government rain-makers ever learn how to make dry weather, I hope they will visit Vermont in haying time. No horse rake for me *in extra heavy grass*, except to rake after the cart. I can take it as the tedder leaves it, and with a fork put it into nice bunches easier and quicker than I can tear apart the wads the horse rake leaves, but there is a knack about this, and a new hand at the business gets left at first. With the modern machines for mowing, spreading and raking, the man who pitches on is the main spoke in the wheel. It needs a tough wiry man, and the fat man, and the one who uses tobacco, had better be elsewhere. Some like to put hay in the mow *green*, I don't. It generally comes out dark-colored or smoky or both. It is possible to dry hay too much, but it is drying too much *on the stump*, that I am most afraid of. Have never fed ensilage, but if you ask what to put in the silo, I answer "grass". Various writers claim that it makes good silage, and I believe it to be the cheapest green fodder we can grow. So

---

whether you feed it green, dry, or pickled, raise grass. More grass means fewer debts, more money in the pocket, more comforts in the farmer's home.

There never was a time when a man could buy a Vermont farm, and pay for it so easily, and enjoy so many comforts and conveniences while doing it, as *now*. After a dozen years trial of the business on a farm twice abandoned by those who made haste to go West and get rich (and got poor), I can earnestly say to my young friends as they become of age. Boys, don't go West to raise cattle, or South to raise cane, but stick to Vermont and raise grass.



## THE HORSE INTEREST OF VERMONT.

---

Read at the Weybridge meeting by E. C. RYDER.

For a number of years the horse interests of Vermont have been sadly neglected.

There was a time when next to her fair women and her Green Mountain boys, horses were her pride. This was right, for no other state ever boasted of a Black Hawk, with his fascinating beauty and his wonderful intelligence, or an Ethan Allen with his great speed and mighty endurance, and it is doubtful, all things considered, if the world has every produced the equal of these two horses.

"Adirondack Murray," the great student of nature, expresses, I am sure, the sentiments of every lover of the horse when he says in his tribute to the great Ethan Allen:

"Forget thee thou King of the Morgans! May the green grasses of her summer wither with ashes, and the snows of her winter melt under the fires that bring the end of the world, before the sons and daughters of Vermont forget thee, thou eagle of her hills, thou pride of her Green Mountains;" and gentlemen, my whole object in consenting, when requested by the chairman of your managing committee to furnish a paper upon this subject, was to awaken a livelier interest in the state, and especially to interest you, gentlemen of the Board, in this great department of agriculture. It is our candid opinion, that of all the stock a Vermont farmer may raise—next to healthy boys and girls—horses are the most profitable. Whenever horses are discussed the subject is always brought up, will prices keep up or like Jersey cattle, will the bottom drop completely out in the next few years?

There is certainly no reason why a drop should be looked for. The supply of really first class stock is not by any means equal to the demand. Did you ever know of a first class horse that there was not a market for at a good round price? We are but a short

distance from two of the best horse markets in the world, Boston and New York, and the foreign markets are sure to call on us for numberless fine and fast horses.

In almost every part of Europe the people are becoming interested in the American horse. In a few years the demand for horses for the foreign market will cut a very important figure in the finance of our state, if we only have the goods.

Rich men are growing richer and more prosperous every year. The interest in horses is steadily increasing, in fact; look where you will the outlook is most promising and horses have the call.

(Please remember I am speaking of the better class of horses, such as every one should raise and not the miserable ill-built mongrel brute, that is fit only for a *swoop-hoss*.) Why then should we look for the market to drop? On the other hand, we may expect it to advance steadily year by year. It is an even healthy growth, warranted by all the attending circumstances. Prices are based on actual value and not as in the case of Jersey cattle or Merino sheep, inflated, because of a craze for a specific breed.

The one great lesson for stock raisers to learn is, begin at the top and breed up. You cannot begin below the scale and breed beyond it and besides you consume valuable time in the attempt. If you begin at the top, every generation which is added to your stock is a step in advance, but if you begin at the other end you have to reach the standard of excellency as it now exists, but by time you have reached *this* standard it has, in the meantime, advanced and you are as far from the goal for which you are striving as when you began. If beginners would only realize this truth there would be fewer failures and more satisfactory results. It is much better to buy one choice mare, and that the very best your means will allow, and then breed her to the best horse you can get access to—not sticking for a little extra service fee—than to start in with a dozen common, half-bred horses and attempt to breed up. By pursuing the former course you place yourself at once on a level with the first breeders of the country and animals of your raising are sought after as soon as born by gentlemen of means who are willing to pay the price; while if you pursue the cheap plan you must remain in obscurity until you become dis-

gusted with the whole business, or sell your stock at prices that will barely cover the expense of raising.

To become a successful breeder a man must *know* a horse. This does not mean that he must be able to tell a horse from a cow, or a draft horse from a thoroughbred, but he must be able to tell at once the degree of perfection at all points that the animal has attained. He must know how to buy and sell, how to handle his brood mares, how to feed and how to manage them during foaling time. When he knows all this and the foal is dropped, his work has just commenced. No matter how highly bred and carefully nurtured a colt may be, if he is not carefully trained and properly developed he becomes almost worthless. Many promising colts have been ruined by standing in the barn with high feed and little exercise. We have all known of instances like this. A man may possess the knowledge and yet make a total failure of the business by blindly ignoring individual merit. Speed is one of the most attractive features of the business and always to be considered in connection with it, yet it would be folly for breeders in this State to breed for that alone. Every man who has studied the matter carefully, knows that only a small proportion of well-bred trotters go fast. Roadsters are the most highly prized, for certain purposes, of any class of the equine species.

It is much easier to breed beauty than speed. Beauty of form and carriage does not detract from speed, and what is more worthless than a homely trotter that has not speed enough to be of any account as a race horse, nor yet has the qualities necessary to a good road horse, and is not even fitted by nature to be a good work horse. Always make it a point to breed handsome horses, with speed enough to develop into fine appearing road horses. Avoid breeding to any unsoundness that is liable to be transmitted. An unsound horse is a perpetual source of annoyance to its owner and never a source of profit. Such is not the case with other live stock. When a calf is deformed or blemished all the owner has to do is to give it a blow over the forehead and ship it to market. When a lamb gives indications of an undesirable future career for breeding purposes, the only expense is a small

amount of corn, then ship for the market, but in the case of the horse the breeder is compelled to feed and raise the colt to the great disgust of his heart. There is no market in this country for colt flesh and no way of disposing of this standing nuisance.

There is no greater trouble in breeding what you want in horses than in any other stock, if you only get the type established and then, by judicious inbreeding, retain it. And right here let me say, there is no part of the business that requires more careful study than this inbreeding. Ignorantly used, it is the cause of certain failure, but if used judiciously the results will nearly always be satisfactory. When a blood is kept pure to its own type, in its own family, possessed of the same blood instinct in both male and female, then like begets like and not till then. If I err in this gentleman, let my opinion be controverted. I do not, by any means, consider myself an oracle, but I do believe that by careful study and ten years of experience I have been able to learn something.

There are hundreds of stallions in this state used to-day as stock horses that ought to be subject by law to a little surgical operation for the benefit of the whole country. Our state legislature, in its wisdom, should pass laws to suppress and banish by force these weeds and brutes that threaten to inundate its land and sweep away the very resemblance of horses. Like begets like or the likeness of some ancestor, therefore these imperfect sires beget and fill the state with imperfect stock. They are bred with ignorant and injudicious crossing which is productive in the immediate remove, to all undesirable consequences. The fashion of selling our best mares and breeding those who from age or physical defects are undesirable, must be stopped if we ever expect to be successful. Breed only your best mares.

Though I am a firm believer in pedigree--of itself it is not to be considered, unless merit is behind the individual. The cry to-day is for standard bred horses, but this, of itself, means nothing unless backed up by individual merit. Many of the best producers have been non-standard, and many others have had, what fashion called a faulty pedigree. Has the individual sufficient merit in himself or herself to warrant using ?

High strains of blood, from a powerful race, coupled with individual merit, constitutes the standard of value.

The market price of first-class roadsters has risen to high figures on account of the rivalry of men of wealth to secure possession of the kings of the road, until \$40,000 and even more have been paid for celebrated champions of the highway. Is there any stock a farmer can raise that will yield larger profits on the cost of production? We may not all raise a Maud S. but we can all raise good roadsters, and many of the greatest trotters and high priced horses of the land were raised by no brighter farmers than you and I. The owner sold them (if he was wise), for a much larger price and profit than his neighbors sold his mongrel.

There must be, to every one, a great satisfaction in owning, and a pleasure in using, the safe and agreeable family servant, that caters to the healthy recreation of his master and stays out the battle of long endurance. The horse is the best servant of man. He aids human labor in developing our agricultural, mineral and manufacturing resources that make up the commerce of the world. Should not his breeding be studied then by every breeder of our state? Should he not receive as much attention from you, gentlemen of the Board, as the cow or the sheep, or even the omnivorous swine?

As to the most desirable breed of horses for us to raise, there are as many opinions as there are breeds. Prejudice is a fearful damper to any enterprise and especially to horse breeding. My own choice is our native Morgans. I am aware that the man who attempts to champion the Morgans in these days is treading on dangerous ground. But where is the man that has ever owned and driven a well bred one, who has not loved him for his many lovable qualities. We love him for his ambition, docility, courage, spirit and beauty of form, which as a class he possesses in a greater degree than any other breed known. But it is said they are too small. Under what rule do you measure? Physically, he is not very large, as a rule, but there is a great deal of horse in him in spite of his size. In the stable he weighs, it may be only 900 or 1,000 lbs. and stands barely fifteen hands high, but when you lead him out of the stall, after a good night's rest and begin to put the

harness on him, he grows with every strap you buckle, and on the road he weighs a ton, and takes a steep hill like a high pressure engine, everything whizzing. They are tough as elm tree knots and closely fibered, they have good feet, stout legs and strong stomachs. Do you find these qualities, as a rule, in any other breed?

Now and then one is spiced with a pungent dash of temper, but they are never stubborn. Like a high bred woman, their management call for intelligence and wisdom, good sense and affection, but granted these, and what help mates they make. To hold the rein, on a frosty morning, over a pair of such roadsters, is enough to make a man of correct religious conceptions, keep saying hallelujah, all the while. Yes, the well bred Morgans are the very embodiment of every quality and characteristic which is called for in the roadster. Now, I am not one of those who wish to claim all that is good for the Morgan, but I do think they have done much towards making the present trotter what he is. They come as near being the natural trotter as any horse that lives, and, considering the opportunities they have had, I think they make a very creditable showing in that class.

Nelson, the fastest entire horse the world has ever produced, traces many times to the Morgan. I am aware, that to many breeders, Morgan blood smells sweeter when called by some other name, but Morgan is good enough for me, and all I ask is that they receive what praise is justly their due, and I believe that within ten years breeders will be looking up that blood in their stock and they will be as anxious to bring it to light as they are now to cover it up, and I think it will stand us in hand to have some of it then.

The old time idea, that to be a horseman, in the horse business, one must not have too many scruples of honesty or pay too much attention to morals or character, that it was a business tending to lower a man's better self, is to-day advocated only by the uninformed. Some of the finest men I ever met, honest men, temperance men, men of wealth and character, that would scorn to do a mean thing, have been horsemen. The breeding of fine and blooded horses, as a business, has a

tendency to elevate one as much higher than the breeding of cattle and sheep, as the intelligence of the former is greater than that of the latter, and, Gentlemen of the Board, it has been a matter of regret to me, in attending the interesting and instructive meetings which you have held in this county, that not one of you has championed the horse, that you have not told us how to breed and manage this noble animal, that we might profit by your wisdom and experience.

Our own state has appropriated \$1000 annually for the dairy interests of the state. This is right, but, gentlemen, why not something for the horse interests?

In conclusion, would it be in order for me to suggest to the members of this Board, and all others interested in the financial prosperity of our state—that we bring our influence to bear upon our Governor, that the next appointment on this Board shall be a man who will work for the horse interests of the state, a man of push and ability, a man of character, who will lift this interest up to its proper plane and hold it before the people as the best interest of our Green Mountain State.

## FRUIT TREES.

---

Read at the Weybridge Institute.

Fruit is the most perfect union of the useful and beautiful; one of the greatest temporal blessings that has come to cheer man all through the ages. What more beautiful than after a tardy New England winter has given place to spring to look upon the trees fragrant with bloom—farther on laden with rich bloom-dusted fruit, melting and luscious. Such are the treasure of the orchard and garden, temptingly offered to every land holder.

Having decided to set an orchard, prepare your ground as for a good field of corn. A field that has been thoroughly tilled for a year or so, would be better than one recently turned over, since the trees can be set earlier in the spring. The soil light and fine, should be free from manure that is in lumps, having previous to the present time received all the fertilization necessary. The lay or slope of the ground has little to do with success. It must not be what would be termed wet land. I should prefer a northern to a southern exposure. Having fitted your ground stake off both ways, not less than 30 feet, and 40 feet would be better for tillage and the value of the crop.

In the selecting of the trees and the varieties lies the success of the orchard in cash returns in years to come. A great mistake, in fact the greatest mistake of men in the transplanting of all trees is to get them too large, in the belief that they will gain 3 or 4 years—this is wrong. Your humble servant, while on the road some years ago selling fruit trees, every now and then would come to a man that would insist on having what nursery men call bearing trees. There were three or four years that we handled hundreds of these larger trees. I always felt it would have been safe to warrant them never to bear—as most of them died.

I should insist on having 2 year old stock, you will get it a little cheaper—but that is not the point—you will get the largest of



that age, a fine thrifty tree, and in taking it up you will save all the roots. There is the value of your tree. You might with as much reason go and buy an old cow that had lost the last tooth, and flatter yourself that you have a treasure for the next ten years, as to procure a lot of over-grown trees with two-thirds of the roots cut off and left in the soil where they grew.

The roots of all trees should never become dry before setting. I should avoid healed in stock as far as possible. Any root that is not surrounded by soil during the freezing and thawing of one winter is dead. In setting trees never use water—arrange the roots as near as they formerly grew as possible with fine soil intermingled, them thoroughly tread. On clay ground it would be better not to set too deep. In setting smaller trees you will find it much less labor, and you can form the heads to your liking much better, and at the end of a very few years you have finer stand of thrifty trees, than if you had started with larger trees, many of which died, some trying still to decide what to do about giving up the ship.

The number of varieties should be governed, of course, by what is expected of the orchard in the future, whether for family use or market purposes. This rule will apply to all fruit trees. One failure, a great one, is setting too many varieties, where a cash return is looked for. I knew a man setting 95 trees; he had 53 varieties—that orchard is a failure, practically not enough of one variety to amount to anything. The fruit when it is all gathered in is like a lot of store butter, bound to go for a small price when placed on the market. There are thousands of varieties, all having more or less merit. But one setting an orchard will do well to stick by the tried and true varieties in the main, letting others try and experiment with the novelties. In setting 100 trees I would not have but four varieties, all winter apples, and they should be red or nearly so.

Most of the orchard should be tilled for years. In fact, it will never become too old to respond to it, and my main desire at this time is to try and secure the ploughing of the orchards we now have. I hope some of the thrifty farmers present will decide before the frost is out this coming spring to put in the plough.

First apply a liberal coat of manure and turn it in. Plough shallow as you near the trees, then make it a good job with the spade.

I have witnessed during the past year many attempts to help fruit trees by top-dressing or piling up two wheelbarrowfuls right about the trunk. If you are bound to top-dress only, you should spread your fertilizer a little farther than the ends of the limbs. You can get an orchard too rich, and grow the trees so fast that they will not bear. But most of our mistakes are on the other hand. Oh, no, they say, it is a bother to plough an orchard—and I guess it will be all right—so is your wood-lot, and about as profitable. By tilling the orchard you will not only double and treble the quantity, but the quality and flavor will be wonderfully enhanced. You ask any intelligent dairyman that is at this time of the year making *gilt-edge* butter, if he could not with propriety, leave out the meal. He would laugh at you. He would tell you, if he told you what we all believe, that the proper ingredients have first to be given to the cow. Of course the sun has a great work to perform here, but it will be done in no slipshod manner where the opportunity is granted.

Trimming should be done in the spring, and before the buds start. Some say trim any time when the saw is sharp; this is a mistake if you wish the best results. The wounds will not grow over so well and the first you know you will have decayed spots. The pruning shears are all of them very poor tools, compared with a fine saw. If a limb of any size is cut with the clippers, you have too long a stub left, and if it is crackled so it will take moisture, it will die back a little and you soon have a poor spot, in many instances running to the centre or heart.

There are but few, if any, orchards in this section but need trimming. The most successful orchardists in the country trim often, or annually, and thoroughly open up the tops. All are aware how poor an apple is and all other fruit, except some of the berries, that have not had any *sun*. That is where our red apples get the fine color.

The apple crop of the Champlain valley in the near future will become one of the most profitable crops grown. The largest part of the apples grown in this section have been handled by one

firm for years, and they have plenty of inquiry for Vermont apples. Let us try and send better stock in the future; we can do it. In this as in all business, be alive. Those of us the past fall who sent their apples in the first shipment of two cars, got some 70 cents per barrel more than any of the last four car-lots sent.

I am of the opinion that winter pears will pay well if shipped, and the past fall sold at \$3 per barrel in the market. Pears do finely on clay ground. The trees are grown on clay soils almost wholly. They require a strong soil. It would be necessary to avoid too much water. It would be well to run an under-drain through the field setting the trees on this, when all would be well.

The plum crop is a paying one and the trees come into bearing early, which of course, means short lived, as compared to apple trees. The past fall was the only time I have ever seen when our home market would not take at paying prices all the plums to be had, and I am glad, for once, that as a people we had enough.

We have in Orwell a cherry orchard of fifty trees, set a year ago, doing well, and in time will trouble the robins in the neighborhood as to how they shall manage to sample all the fruit during the few days allotted them.

My closing words are, till the fruit trees; if you never have, commence this year.

Thorough tillage is what gave John Hopkins of Western New York (many of you knew him formerly, an Orwell boy, now a large fruit grower on the banks of the Niagara), his wonderful Bartlett pear crop a year ago. When no one had any he sold his to a canning factory at a high price; after paying expenses to the amount of \$336, he had as a net income from three acres \$2,563. Every tree was dug around and hoed as a hill of corn.

## MARKET GARDENING.

---

Delivered by MR. W. W. RAWSON of Arlington, Mass., in the Farmers' Course at the Agricultural College at Burlington.

This business has increased more the last ten years than any other branch of agriculture. There are many now engaged in it who do not understand it, and for this reason success depends more on the man than on anything else. He should fit himself for the business and then he will be sure of success. But some may ask, how can this be done? My answer is to get a good school education, and, if time will allow, go through the Agricultural College. Then go to work for some one who understands the business, for five years at least. He will then be about twenty-five years old. If he has been attentive to his business and saving, he may have at his command perhaps \$1,000. With this he can hire a small place near some large city, where there is a good market and land is cheap, and get a good start in about five years more. He may increase his stock of sash and hot-houses as fast as his funds will allow, and a little faster perhaps, and at the end of ten years he will be surprised to find himself worth \$10,000, at least, and everything laid out for doing business. But if he had not given this five years of practical education he would not have one-half that sum, if he had anything. The time has come when to be a market gardener or a farmer the man must be educated for it, and the more brains and common sense he has to go with it the greater will be his success.

There is no kind of business carried on at the present time, that the man engaged in it knows so little about, as farming. Who would think of being a doctor, a lawyer, a minister, a machinist, a teacher, a manufacturer, or a merchant without at first spending at least ten years, sometimes twenty, fitting himself for his calling? Who ever saw a successful one who did not? And how many of these confine themselves to eight or ten hours a day for their work? I never saw a successful man in any kind of business

who did not spend from twelve to fifteen hours per day for the first ten to twenty years of his business career, and what business is there at present that will give better returns for the time and money invested than market gardening or farming. We do not get rich, I know, but we can have a nice farm and buildings and everything to go with them, and pay all our bills and have something left every year.

And who feels richer than such a man? I well remember the time when I was first out of debt. I never shall feel as rich again. I owned my place and everything on it, and the whole cost me \$35,000. My business has increased three times since then, but I do not feel as well off to-day. I worked night and day for it, and so will you if you succeed.

#### LOCATION.

This should be on a slope to the east, south or west. Sloping, because it inclines to the sun and is better for irrigation, and towards these points because they are warmer than a northerly slope. The soil should be a sandy loam, with a few acres of low land if it can be had, but one acre of upland of the right kind is worth two of the low.

Size according to the extent of business, which depends upon where the market is and the size of the market; but ten acres is sufficient in most cases. It will take about \$5,000 to stock in good shape for the business. This will consist of three horses, with wagons and harnesses; 200 cords of manure; 500 sashes and one green-house. This may exceed that amount of capital a little.

#### MANURES.

I have already mentioned 200 cords of manure, which is little enough. Fertilizers may be used with the manure, if thought necessary. Twenty cords of good manure to the acre will grow most any crop that can be grown, and in some cases two crops at one application. If the land has been worked for a long time, some fertilizer may be applied for the second crop when partly grown. It should be whatever material the crop is mostly composed of and

should be applied when the crop is about half grown. It may be applied broadcast or in the rows, as the crop may be arranged, and never less than half a ton per acre.

I believe in liberal application of manures and fertilizers, because I believe in liberal feeding of plants as well as animals. If you have an animal and feed him well, he will always look well and show his keeping. It is so with plants. If they are well supplied with the proper nourishment they will show it, and a plant or animal that is well fed is easier to take care of than one that is not, and if there is any profit in a crop, it is always in a good one.

What kind of fertilizer do you invest in? I invest in stable manure. It depends a great deal upon the crop you will grow, and the soil you are to grow it on. In market gardening we generally grow two or three crops a year; perhaps the manure will help the first crop along first rate, and the second crop may need some fertilizer which can be applied when the crop is half grown. The kind of fertilizer would depend upon the crop; some crops require more potash than others, and some will require more ammonia than potash. You should put on a ton to an acre of fertilizer. Do not put on any less; if you put on only three or four hundred pounds it will not do much good. I never say anything against fertilizers, because they have reduced the price of manure so much that I can get all I want. On 100 hundred acres of land I use 3,000 cords of manure every year. Fertilizers, about 50 tons of ashes and a few tons of sulphate of ammonia, on spinach, perhaps a ton or two of muriate of potash, then a few tons of bones. I put on the fertilizer that the crop requires, and if you do not, you don't know anything about it; for that reason I think that the market gardeners of today should have better education than they now have.

#### HELP.

It is always difficult to employ reliable help, and especially in this business where it is necessary that they have some experience before they are of much value. I have found that by keeping a large number it is easier to get good help than where a small num-

ber is kept, and by keeping them all the year round it is easier still.

Good men can always find work, and for this reason they will not engage themselves unless they are sure of the winter work. I have so arranged my work that I can keep about two-thirds of my summer help through the winter. The wages are from \$35 to \$50 per month for the summer and \$5 less for the winter. The hours are from 5 to 6.30 in summer and 6 to 6 in winter. When ten hours only are worked, as it is in some cases, the wages are \$5 less per month. There are very few American men that work on market gardens at present, because we cannot get men that will do as much work of that class as we can of foreign help, and if you do get one, he will not stay to be of any use to you. They want to do something for themselves and therefore, as a general thing, the employers will not employ them at all. If there is ever any trouble with men about the length of a day we work, it generally starts with them. But when you find a young man that wants to make this his business and takes hold with that idea, he will be a good man and will be worth good wages; but they are very scarce. The saying is "good men are scarce," and it is as true in this business as anywhere.

Q. You employ foreigners, do you make any difference in the class of foreigners?

A. Yes sir, I have to have Irish, and they predominate mostly in our section, and if you mix them up with any other class there is generally trouble. Some have Swedes, but I would as lief have two Irishmen as three Swedes any time. Some farmers prefer to have Americans, but I would rather have one Canadian than three Americans. If I can pay my help as much as they can earn elsewhere, they will stay, and if I can't they will go, and I don't blame them. We pay about the same wages as you have to up here.

#### HOT-HOUSES AND SASHES.

These are necessary at the present time, because by using them is the only way that you are enabled to produce vegetables all the year round, and they are necessary in spring for starting plants.

Some twenty years ago only sash were used ; but at present hot-houses are preferred. However, both are used to a very large extent. Some ten years ago I built three large houses. The old market gardeners said that I would fail in three years, but I have not failed yet and have built as many more ; and these same men now have them and think they are better than sash. If I enlarge any more in the glass business it will be in houses. There is more depreciation in houses than in sashes. Where the houses would not bring over one-third their cost after five years use, the sash would bring two-thirds their cost after from ten to fifteen years use ; but a house will pay for itself in three years.

Q. What has been your experience with ashes ?

A. I use it a little.

Q. More than phosphate ?

A. Yes.

Q. Mostly for crops or for land ?

A. For both.

Q. Which do you consider best, leached or unleached ashes ?

A. I do not consider unleached ashes worth teaming.

Q. Do you think ashes work as well as phosphate with an early crop ?

A. No sir. I think ashes should be applied the fall before for a crop that has to be taken off next season. You get the benefit of it the next year. I generally put it on and plow up to the crop and send a stream of water down the furrow, and it works the ashes in in a pretty good shape. That is what we call irrigation.

Q. What is the cost of an ordinary hot-house, 100 feet long, the usual width ?

A. \$10 a running foot, 24 to 25 feet wide, built just as long as you need it, if you put it up economically. This includes the heat and everything to start it going.

Q. How do you heat ?

A. Small pipe with steam. You will find steam better for large establishments and water for small ones. If a person has an establishment large enough and can keep a night man, steam is better because you can regulate the heat easier.



Q. What style of sash do you apply ?

A. A lean-to roof for lettuce and cucumbers in April, but for cucumbers in winter I should apply a span roof with two thicknesses of glass, then you can take the inside one out in April if you choose.

Q. How much space between the glasses ?

A. About one inch ; you want enough to run some water between to wash the dirt off. The double glass is to keep the frost out in winter time ; it will make a difference of from 10 to 15 degrees in the temperature. I do not practice the growing of cucumbers much in the winter season, because there are too many men who are doing that kind of business and do not want to do anything else. I will grow mine in the spring when their's have all done bearing. Hot-bed sashes, I suppose, are used a great deal in this section as they are in Massachusetts, and the heat in them is from manure generally. It takes about a cord of coarse manure to heat eight sashes. I have 3,000 sashes and it takes quite a pile of manure to get them heated.

#### PREPARATION OF THE SOIL.

In preparing the soil for planting the crops, it should be well ploughed and thoroughly worked. Two ploughings are none too much, leaving the manure quite near the surface. Never work the land when it is wet. Plant the early crops at the proper time, not putting in the corn or beans before the ground becomes warm, for if they are planted too soon a second planting will be necessary, and this makes an additional expense.

#### SEEDS.

Select your seeds early, of such kinds as your soil and market are best adapted for, and plant those you have the best success with. For seeds you have to buy, go to the best man you know of and give him a list of what you want. If he has the list early, he will have time to select you the best and he will be sure to have them then, if he has them at all. Always buy the best and highest priced seeds. You are surer of the best by paying the highest

price, because dealers never put highest prices on poorest seeds. Pay cash for them if you can, and if there is a discount you can get it then. I will not say much on this subject, more than I have already said, because it is one of my lines and I speak from experience I had before I took up the seed business.

#### CROPS.

I will go over the list of vegetables grown by market gardeners and briefly describe them.

*Asparagus*.—This is grown to great extent on land some distance from the market, because it can be easily shipped from a distance. But, like all vegetables, it is best when fresh. The seed can be sown and the plants transplanted when one or two years old into rows four feet apart, with plants one foot apart in the rows. The roots should be spread out when set and not put down straight, like a cabbage plant. The heads should be placed about six inches below the surface. The ground should be well worked before setting the plants, and then kept clean between the rows for two years, at which time cutting may be commenced. It is not well to cut very heavy for a year or two, nor is it best to keep up the cutting too late in the season.

An application of about ten cords of manure or about 1,500 pounds of bone and potash may be made each season, in the fall. The tops should be left on the ground through the winter if fertilizer is used, but if manure is applied they may be cut off and burned. This should be done very late in the season.

Q. How far do you plant the rows?

A. In rows of four feet, the plants one foot apart in a row. Asparagus is being grown somewhat now under glass, the hot-house roots being taken up when they are from three to four weeks old.

Q. How late do you get asparagus?

A. It depends a little upon the season. Some years you will get it two weeks earlier than you do others. When peas get into the market, asparagus is quite cheap, as a general thing.

Q. Do you have any trouble with the asparagus beetle in your section?

A. No sir, a very few do, here and there.

Q. Do you know what to apply to them ?

A. I should try lime.

*Artichoke.*—These are not very extensively grown in this country and are mostly used for pickling.

*Beets.*—There are a variety of kinds and we will speak of them in their earliness of growth. The earliest of all is the Improved Egyptian. This particular strain, of which I speak, has not been grown to any extent for more than one or two years. It is the most profitable beet grown at the present time. Only two seedsmen I know of have it for sale. They grow very smooth and regular and pull off at two pullings, and are mostly used for bunching. They are grown quite extensively under glass. The Eclipse and Bastian come next. They are about one week later and make a larger top than the first mentioned. The Dewings and Favorite follow a few days later for bunching and boxing. The Favorite is the best, being a very smooth beet; does not grow very large, and is a true blood. The Edmund comes about one week later. It is a true blood but is coarser and grows larger than the Favorite or Dewings. There is a long, red beet, but it is very little used at the present time.

The cultivation should be a liberal manuring and well-worked light land for the early sorts. Most of this land is raked by hand and made quite smooth so that the seed can be sown at a regular depth.

Sow one inch deep for early, and one and one-half for late. Of these early varieties two crops can be grown each season on the same land. They are rank feeders and will grow best on old land. If the grub troubles, put on the land a good coat of air-slacked lime.

Q. What grub do you mean ?

A. A little dark colored grub that eats them. He will gnaw a hole right around the edge of the beet. Sometimes he will bite the root right off.

*Beans.*—These are grown on light, sandy, warm land for early ones and stronger land for late. They will take a liberal amount manure and fertilizer. I have the best success manuring broadcast

and putting fertilizer in the hills or rows. The earliest is the Six Weeks or Mohawk. Next in order is the Yellow Cranberry, then the Wax. There are quite a number of these, as the Flageolet, Golden Wax, and Golden Yellow Eye. This last named does not spot, and was the only one of the Wax varieties that did not the past season. The cause of some beans spotting is that they are sown too thick in the rows. The dew gets on them and they do not get dry all day, and where the dew is on the pod, there the spot will be, and after a heavy rain and dull weather for a few days they will spot very badly. The Yellow Eye does not spot. It has been in the market only two years. The Horticultural is a shell bean. There are quite a number of kinds of this variety. One I have, a new one called Ruby. The Goddard is a heavy yielder. All I have mentioned are bush beans. Of the Lima there are four or five kinds, and of the Wax two or three. Then comes the Cranberry and White Runner. The pole varieties will grow on heavier land than the bush.

Q. What causes the beans to spot so after they have been picked ?

A. I will give it up. We do not keep them long enough after they have been picked, to know. The Golden Wax bean is about run out; it was once the nicest bean there was. It spots almost everywhere; there is only about one year in five that it will not spot. This Yellow Eye bean I have never known to spot; I have sold it for two years and have never heard of a case where it spotted.

Q. Is this Yellow Eye Bean the same as that sold for the dry bean ?

A. No sir, it is not. It does not look like it; it is not quite as large.

Q. Is the Yellow Eye a pole bean ?

A. No sir, it is a bush bean.

*Cabbage.*—This is the largest of vegetables and stands among the first of profitable crops. The varieties are numerous. The Volunteer, Express, Etamps, Jersey Wakefield, Early York, Summer, Oxheart, Winnigstadt, Flat Dutch, Brunswick, Stone Mason, Drumhead, Red, Curled Savoy, and Drumhead Savoy. The earliest

is the Volunteer, but they are small. These two, Early York and Wakefield, are called the early ones, but the Summer can be grown at any season and is largely grown in New England.

Cabbages grow best on good land, but the early ones will do best on light land, well manured, with plenty of water for irrigating. Twenty-five cords of manure and one ton of fertilizer will grow a good crop of cabbages any year on most any kind of land, if sufficient moisture is supplied.

Q. Why is it the regular seedsman puts down both the All Season and Summer varieties ?

A. So that he can sell more cabbage seed, I suppose. This All Season is grown from the same cabbage. It is a selection from the Summer Cabbage. The Summer cabbage is a cross of the Early Wakefield and the Flat Dutch. It was originated by Mr. Van Sickler in Long Island. In some sections they will run to the Wakefield and in other to the Flat Dutch ; now those that run to Flat Dutch you can take and call "All Season."

Q. What does the manure and fertilizer cost ?

A. About \$180.

Q. Do you have any trouble with white maggots in the spring of the year ?

A. Yes sir, when the cabbage gets about half grown they begin to eat the roots. The only remedy that I know, is to hoe up to the cabbages and tread the loam around the plants. It may delay your crop two weeks, but you will get a good crop of cabbages. I have tried it and others have tried it and saved their crops.

Q. How often can cabbage be followed ?

A. Once in three years. It is not safe to follow them oftener, still you may get one in two years.

Q. What do you do to prevent stumpfoot cabbage ?

A. Don't put them on that piece of land again. It is caused by their being placed on land too often, and also being placed in a low place where water stands.

Q. Can you follow two crops of cabbage ?

A. You can grow two crops of cabbage the same year and

get two good crops on one manuring, but not the following year.

Q. Do you follow on your land 25 cords of manure every year ?

A. Yes sir, I use 3,000 cords of manure on 100 acres of land every year.

Q. What kind of soil is it ?

A. Light, loose, clay at about 20 feet.

Q. Did you ever see land with too much manure on it ?

A. No, sir. Those who talk about that, want to sell fertilizers. It gets manure down to about half the price for me though. I put on one piece of land 35 cords of manure and one ton of fertilizer every year.

*Cauliflower.*—This is one of the cabbage family, though unlike it when matured for market. It is not so easily grown and costs more, and we expect to get more for them, but sometimes do not. When the season is very wet it is a good year for cauliflowers; but if it is a dry year they will not mature as well unless the necessary moisture is supplied. They will do best on new land, and will consume a very large amount of manure, if applied. I have put twenty-five cords of new manure and packed it into the furrows when turning over the sod, and then applied ten cords of fine manure per acre and harrowed it in. Then when the crop was about half grown put on one ton of fertilizer per acre, and, when the weather was dry, kept a steam pump running night and day for two weeks or until it rained. The crop paid well. This piece of land was about six acres in size. I could wet it over twice a week with about half an inch of water on a level each time. I did not have the arrangements for watering that I now have. I can water four acres in twenty-four hours, and put on a level an inch of water.

The price usually obtained for cauliflowers is \$1 per dozen, but when they are \$2 per dozen there is some profit in them. An acre at that price will bring \$1,000.

Set in rows three and one-half feet apart and two feet apart in the rows. There is some trouble in raising the plants, and unless a large quantity is grown they are sometimes neglected and the

little black fly takes them down. But perhaps this is my benefit, because I raise a large quantity of plants to sell, and by selling the seed I generally sell the same parties the plants after they have lost all of theirs. This vegetable is quite largely grown in New England at present, and on Long Island. There are quite a number of kinds. The Erfurt, Snowball, Paris and Algiers. A few years ago most of the cauliflowers used for pickling were imported, but since we have been able to supply the picklers for four cents per pound, they have imported but very few. I sold this season six tons of cauliflowers to one man for pickles. Most of these were of No. 2 quality. They cannot be grown on the same land in New England more than once in three years.

*Celery.*—The next and one of the most important crops grown, especially in the fall, is celery, and there is none that has increased in demand so much during the past six years. The seed is sown about April 1st, and the plants are transplanted in June, either into rows where they are to grow, or into beds where they they will stand until July, and be set out after some crop that has been taken off before that time. It is set in rows six feet apart, so as to allow for banking, and one foot in the rows for the branching kinds and six inches for those that do not branch.

There are quite a number of kinds. Boston Market, Arlington, White Plume, Paris Golden and Golden Heart. The first two are grown largely in New England and the West. The Paris Golden is quite new, only being in the market two years. I cannot tell whether it has come to stay or not until after another season. Celery requires more time and attention than any other outdoor crop. It is not a very profitable crop, but at \$1 per dozen bunches it will pay for growing.

Q. Are you obliged to have the seed in as early as the 1st of April?

A. No sir, not obliged to, but you won't get as good celery if you don't.

Q. Doesn't the frost affect celery?

A. If you can work your land as early to sow onions you can sow celery.

Q. Will it do to sow it when you plant onions first?

A. Yes sir. My day is the 5th day of April, because I had some go to seed on me on the 4th day, so I have followed the 5th day ever since. The first of the month, or anywhere along there if you want to get your plants ready to transplant early. If you want to have them in June you must sow them pretty early in April. There always comes a time in June when we can't transplant them and I always calculate for it. I will set the first time I get the chance in June, 15 or 20 acres. If I did not sow this in April I would have no plants to set.

Q. Do you have any choice soil for celery growing?

A. Yes sir, I like sandy soil, such as you grow cabbage in, with plenty of water. Low land will grow good celery during a dry year, but in a year like this it will grow it good for nothing, and when you want to dig it you will have to get a boat and row for it.

*Cucumbers.*—These are grown very extensively in houses and under glass. The increased demand has been such that they are grown all the year round, but to grow them in winter is quite a trade. They require an even temperature of 70 degrees, and the more sun in winter they can get the better it is for them. In winter the crop is mostly shipped to New York and Chicago. The prices are very changeable and vary from ten to twenty-five cents apiece. Many may think this a very large price, but for the quantity obtained at this season, it is not. I had rather raise them for five cents apiece in May and June than for ten cents apiece in December and January. Houses are constructed for their growth with span roof and double glass. The glass being double, the temperature can be kept more uniform than with single glass, and the amount of coal saved will pay for the additional cost of glass. There is a great difference in the crop of cucumbers made by the selection of the seed. The age of the seed is also quite important; that is, old seed will bear more than new, but the new will grow the most vines. Therefore, I have selected seed for my own use, and also for sale, from the very best specimens, and then after the seed is two years old, it is fit for planting or selling. I have had many tell me that they never had such crops of cucumbers as my



seed would produce. I sold one man last season fifty pounds at one time to plant in Savannah, because he had bought one pound the year before and had such a fine crop. This is one of my specialties on my market garden and in my seed store. In the field they will do best on new land, and will also yield best by rotation. In transplanting, if planted in a sod about eight inches square, they can be handled very easily and are not disturbed so as to affect their growth. In houses, if transplanted into pots, they can be carried easily from one house to another. Eight inch pots are the proper size,

Q. In growing them, do you want to train the vines against the glass in the hot-houses ?

A. We run them up generally on the trellis not too close to the glass, so as not to burn the leaves in the spring time when the sun is hot. About a foot from the glass is the right distance.

*Carrots.*—These are grown in the field for bunching and also under glass. They are also grown for stock but not in the market garden to any extent. The kinds are French Horn, for forcing, Half Long Scarlet, Early Horn, Intermediate, Dauvers, Half Long Garentan, Long Orange, White Belgium and Chantenay. The soil for growing carrots should be a deep, sandy loam, well worked and manured.

*Corn.*—There are very many kinds of corn grown at the present time. Among the earliest are the Corey, Crosby, and Marblehead ; then Moore's Early and Potter's Excelsior ; and then Mammoth sweet and Stowell's Evergreen for late. It takes good land to grow corn, and where corn will grow to perfection most anything else will. It requires plenty of manure.

*Dandelion.*—This is grown quite extensively in New England and used as greens in the spring. They are grown by sowing the seed in the spring, and in the fall the plants will have attained a large root, which will live in the ground over winter and will start very early the next spring. They can be dug up and set out under glass or in the hot-houses and come into market any time in the winter. It takes only about four weeks in the hot-house to obtain a crop, but if set in beds for sash it takes longer. The glass can be placed upon them when they are sown in the field and will

hasten their growth very much. They are used very extensively and are put up in cans and kept like tomatoes, squashes and pears. If fifty cents per bushel can be realized for the whole crop, it is quite profitable.

Q. When you take the roots from the ground do you set them right away ?

A. Yes sir, we set them in a bed and keep them covered and not let them freeze.

Q. Do you take them out of that bed during the winter, any time ?

A. Yes sir.

*Egg Plant.*—This is grown to some extent, but the sale being quite limited, very few are grown. They are quite delicate and require warm, well manured land with plenty of water. The kinds are the New York, Improved, and Black Pekin.

*Endive.*—This is very little used. The varieties are the Broad Leafed, French Moss and Green Curled. When grown this requires blanching before it is fit for use.

*Leek.*—This is a member of the onion family and is used for flavoring.

*Lettuce.*—This is one of the most extensive crops grown by market gardeners. When it is grown all the year round, it is necessary to sow the seed once a week. This crop is grown in the field, under glass and in hot houses. The kinds mostly grown in Massachusetts are the headed variety; White Seed Tennisball for winter, and Black Seed Tennisball for summer. In other localities various kinds are used, but there is more of the White seed Tennisball than any other in New England. You will be surprised when I say there is more money's worth of lettuce grown in Massachusetts than any other vegetable. There are few market gardeners who do not raise \$1,000 worth. Many grow from \$5,000 to \$10,000 worth, and a few produce as high as \$20,000 worth per annum. The most of this is used in New York markets and sent from Boston.

*Melons.*—There are three classes of these, the cantolope or green flesh, the musk or yellow flesh; and the water melon. The first is the earliest and is used, as all the varieties are, for dessert

upon the table. There are many that are favorite in various localities. The Montreal is the favorite in Canada; the Arlington, Green Nutmeg, Hackensack and Japan in Boston; the Gem, Perfection, Banana in New York, and the Osage in Chicago. Water melons are mostly grown in the South and shipped North for sale. They all do best on new land. Our land which has been used for a number of years does not produce good melons. They were a total failure last season.

*Mushrooms.*—These are quite extensively grown in New England. The kind is the English. They are very doubtful crop, but if you can get them every second year they will pay quite well.

I can grow them every second year. I know how to mix the preparation, I know what to do with it, but after I have put it in I don't know whether I can get a crop or not.

Q. How do you get it?

A. Take fine stable manure; shake out the coarse part until you have enough of the fine for your bed. Then apply twice as much loam as you do manure. Lay it in a pile and let it heat. Overhaul it every other day for about a week, keeping it covered and dry. Then you can place it in your bed and tread it down very hard; let it remain until the temperature is about 90 degrees. When you put it in the bed it will be about 120 to 130 degrees. Then you place the spawn in the bed about 6 inches apart, covering it over with two inches of fine loam and pressing it down hard with a spade or mallet as you put it on. Then let this stand. If you get a good crop of mushroom, all right, if you don't its just the same. Keep it in the dark. I do not water it until it requires water, and very seldom they do until they begin to come up. It is according to where your bed is and what kind of heat you use. In the winter you may not have to water it. In the spring time you may have to water it some.

*Onions.*—This is one of the largest crops grown, and in some localities almost the only one. When the land will produce 600 bushels per acre, that is the land to grow them on. It has been said that they grow best on old land and every year on the same piece, but I do not think so. They need rotation like all other crops, and where this is done are not so liable to rust, or blight, or

have maggots on them. The kinds are many. The Yellow Danvers is most extensively grown, not only in New England, but in the Western States. The red is mostly grown in New York, New Jersey and Pennsylvania. The white is used for bunching and is sold in that way, green. They grow best on low land, well manured with stable manure and an application of ashes or potash. Some apply the manure in the fall and plough it in and put the fertilizer on in the spring; but I think the best way is to plough it well rotted down, and apply in the spring, turning it under very light and leaving it near the surface. I have tried all ways on the same land and find by so doing I can get my onions planted sooner than by putting the manure on in the fall. Twenty cords of manure, with one ton of fertilizer, is about the amount required for a crop of onions.

Q. Will onions follow turnips?

A. That is something that I never did, but I should say they would. I should try it myself without any doubt.

Q. Isn't new land more apt to grow scullions?

A. I do not know why. The first and second year you will find more scullions than after. Sometimes it is on account of the seed. Western onions will grow more scullions every time. The Eastern onion seed will do best the first year, and Western seed the second year.

*Peas.*—These are grown mostly as an early crop, but there are some later varieties that do quite well. The early kinds are the Clipper, Maud S., Dan. O'Rourke, Kentish and American Wonder. The late are the Advance, Champion, Everbearing, Abundance, Marrowfat and Stratagem.

The early ones are grown mostly as a first crop, another one being planted between, or, in some cases, as a whole crop, and another planted after the peas are gone. I always manure broadcast with stable manure and put fertilizers in the furrows. Then I do not have to manure for my second crop unless it be a crop of cabbage. Peas will not follow each other and do as well as they would if planted on a different place each year.

What is the Yorkshire Hero? It is nearer the Advance than anything I know of. Of course the Champion and Everbearing

are pole peas. I do not grow it because it is not so profitable for me to grow as the Advance.

*Parsnips.*—There are four kinds, namely, Long Smooth, Short Round, Student and Maltese. It requires fine land to grow them and produce smooth, clean ones. For the first named the soil should be very deep and a subsoil plough is necessary to plough the land for them. Manure broadcast and make narrow ridges of the land after ploughing, and put two rows on each ridge.

*Parsley.*—This is grown to a very large extent under glass. For winter use the fine Curled is the favorite. Sow in spring and continue cutting all the season. Put glass upon the bed and a good crop can be cut in winter. It can be transplanted into beds or hot-houses for winter use.

*Peppers.*—These are grown mostly for pickles, and very few are grown by market gardeners.

*Potatoes.*—They are a farm crop and are grown very little by market gardeners, therefore we will not give them much attention.

*Radish.*—These are grown under glass in winter and in hot-houses, also in spring in the field, especially the Long Scarlet, which is used mostly for field culture. For forcing, the French Breakfast and Turnip Rooted are used, being grown much closer than the long variety. They all require very fine soil, and in many localities they cannot be grown because of the peculiar quality of the soil.

*Horse Radish.*—This is unlike the former and is grown as a field crop and is used for grating.

*Rhubarb.*—This is a spring crop and forced to a great extent under glass. The roots are set in the ground under the surface and are left to grow a large root for two or three years and are then taken up and forced. They are of no value after being forced, unless in a bed where they can remain, and by placing glass upon them they will come into market before out-door ones, and they are then left for another year, keeping the weeds down in the summer season. For field culture the roots should be placed three feet by four feet apart, and when the roots get too large, cut out a part of them with a spade. The roots can be set at any season.

*Spinach*.—This crop is grown at all seasons and for winter use is put into pits made for the purpose. But the Southern crop interferes very much with the price in our markets. For spring use it is sown about September 1st, and protected in winter with hay or boughs from pine trees, and in spring it starts up and produces a fine crop for market in April and May.

*Squash*.—This is grown quite extensively in the market gardens and mostly as a second crop, being planted in June. A crop of greens, beets, peas and other vegetables can be grown on the land before it will be needed for the squash crop. They are planted in hills about ten feet apart each way, three plants being left in the hill to grow. When the land is manured broadcast no additional manure is needed for the crop. A shovelful of coal ashes in the hill to keep away the borer is necessary. The kinds are the Yellow Crookneck and White Scollop for summer use, and the Marrow, Hubbard, Essex Hybrid, Bay State, Turban, Marblehead and Pikes Peak for winter. The Marrow is the largest yielder, oftentimes producing ten or more tons per acre, The other varieties do not produce over seven to eight tons, but the difference in price makes the crop bring about the same amount per acre.

*Tomato*.—This is largely grown, and large quantities are put into cans by the factories. This makes it necessary to grow large quantities of them. The kinds are the Boston Market, Emery, Acme, Livingston, Perfection, Beauty, Favorite, Trophy, King Humbert, Canada Victor, Paragon, Cerry, Plum and Peach. Some of these varieties are very large producers, others are only novelties for garden culture and are not profitable for market gardeners. Tomatoes will grow best on quite new land, that is, the second or third year after breaking up, and I find that where they are well manured that the crop will show the benefit of it like every other kind of vegetable. They will require a large amount of moisture and it makes a great difference in the quantity of the yield. I will not say which one is the best for culture, because I find every one has a kind that does well with him, and if so, let him stick to it.

*Turnip*.—These are not grown very extensively by market

gardeners, except by a few who have land that is adapted for them.

Q. Can you get early round turnips nice?

A. No sir, I cannot. There are some sections where they can grow them. I have never tried them on new land. I have tried them on old land, but I could never do anything with them, so I just dropped them.

#### CONCLUSION.

I have now been over the most important part of the business; that is, what the man should be, where the place should be located, capital required, application of manures, and described many of the crops to be grown.

In closing, I will say to him that makes this his calling: Educate yourself for the business, study your land and find out what it will produce most profitably and make a specialty of those crops, use manure liberally, and fertilizers if necessary and you find them profitable to use, do enough business not to make a slave of yourself, and always sell your crops when the market demands them, regardless of price. Remember that plants require light, air, heat and moisture on the one hand, and thorough cultivation and liberal nourishment on the other. Have plenty of help to do the work at the proper time, and you will find that *brains* put into the business of market gardening will tell as much as at the counter, in the manufactory, machine shop or any other department of labor, and it is as true now as ever that "he who by the plow would thrive, must himself either hold or drive."

## GRASSES.

---

Delivered in the Farmers' Lecture Course at the Agricultural College at Burlington, by DR. E. H. JENKINS, Vice-Director of the Connecticut Experiment Station.

Grasses now comprise a single botanical class. Some grasses have underground stems and others have underground blossoms, which seed and grow. All grasses flower and reproduce by seeding. They, as a rule, cross and fertilize and mostly by the agency of wind. There are 300 genera of grasses and from 3,200 to 3,500 species.

The science of seeding and cultivating grass is comparatively new, and the former was not done until 1,677. We have no need to hunt out and try popular forage plants or novelties from the south or west or from Italy or Germany. We have the best already acclimated and established in our pastures and meadows and by our roadsides to-day, and we can have all the pasture and hay from them that we need, without going outside the State, when we know how to use them.

But the point I would make and emphasize now is this. What we chiefly need at this present time is to know more about these common grasses that we already have; know their names, appearance and habits; how they stand grazing and mowing; how long they will stay in the land and why they run out; what soil and treatment they like best, etc., and so know how to treat them rationally and make the most of them. And we need this not only in the general way that a man needs all the education he can get, but it will be spot cash to us; it will be money in our pockets, it will "pay" in the language and sense of the trader who is after dollars, first, last and always. Now I have not come here as a missionary who knows all the truth and is going to tell it. I don't know the gospel of grass. I wish I did, but I want to do what I can to awaken general interest in it.



## A FEW WORDS ABOUT GRASS NAMES.

If I know all about my own grasses what I want and what I don't want, can tell their faces as I can the faces of my family and the look of my cattle, the names are of no special use to me *on my farm*, but the minute we want to talk grass with a neighbor out of sight of the thing itself we are as good as dumb, without a grass speech. The experience of others is of no avail without a "medium of exchange" as the economists call it. We have got to have grass legal tender, names for grasses that will have one meaning and only one, the world over. Such a speech we have not got yet. Names like "meadow grass," for instance, have a very doubtful meaning. "Blue-grass" is applied to two very distinct kinds of grass of very different value. "Panic-grass," "Bent," "Fowl Meadow-grass" are further examples of grass names that are greatly confused, meaning one kind to one man and another thing to another. It matters little what kind of names we finally have for one farm grass talk, provided only that they are perfectly definite. But when in our grass knowledge we go much beyond Timothy and Red-top we have got to find something better than we have now. I wrote Timothy and Red-top but I will only except Timothy. No one confuses that with anything else, but Red-top *is* confused. Within the year I have heard farmers calling Kentucky Blue Grass, Red-top. It is a new idea to many farmers whose pastures bear a plenty of Kentucky Blue Grass, that that grass grows in New England *at all*, whereas it is one of our commonest grasses and no more peculiar to Kentucky than whiskey; both are found all through New England very abundantly, even in the State of Maine. Even "Herd's grass," as common a name as that, may breed confusion; *here* it means the same as Timothy, but in Peru it means what we call Red-top.

The advantage of the scientific or botanical names of grasses is this, that they are precise, they can mean only one thing and so confusion is impossible. The disadvantage is, that they are in a foreign tongue which unnecessarily frightens us. To show how harmless they are however, I have brought with me a list of our commonest grasses which gives also the botanic names and an indication of their pronunciation or rather accent. If you will

try one or two of them in your mouth when no one is looking you will find that they are really no worse than some other names which we use commonly. Twenty years ago it would have been impossible to speak of nitrogen, phosphoric acid, potash, albuminoids, and carbohydrates at a Vermont farmers' meeting but now those things have become ordinary farm tools instead of book farmers' *words* and I hope it will in time come to be the same with grass names. Not that I imagine all these botanic names will be used but some of them I think *will* be, to very great advantage.

Whether is easier to say meadow fox-tail or *Alopecurus pratensis*, orchard grass or *Dactylis*, red top or *Agrostis vulgaris*, taking into account the fact that if you use the popular name you must stop to explain or run the risk of being misapprehended?

I have got wild oat grass in a pasture, what is that? There are at least three grasses each of which is called wild oat grass, *Danthonia*, *Arrhenatherum*, *Elymus*. If I call it poverty grass it may still be one of two very different grasses, but if I say *Danthonia* no one can confuse it with anything else.

This matter of names will bear thinking over.

Now I pass on to say a few words about *knowing grass by its looks*, which is a good deal more immediately important to the farmer than a knowledge of grass *names*. A single incident will show the whole difficulty here. Some months ago I had a letter from a farmer who raises hay for market and has exceptionally good success with it, I think. The letter ran as follows:

"Enclosed is a specimen of the stuff that is growing on ten acres that I sowed with seed I bought one year ago of parties in Meriden for orchard grass. What is it? There is only a very small quantity of orchard grass scattered over the lot, possibly one tenth of the whole growth. Would it be better to let it grow, or to plow up the lot and try to kill it out? I am afraid I have got to growing something that I shall wish was knocked in the head."

At the same time that he wrote me he also wrote to the party of whom he bought the seed, complaining that it was not orchard grass and sending them also a sample of the grass which was then in flower. They replied to this effect, and I

ought to say that they are a reputable firm with a reputation to keep and I believe were perfectly honest in the matter :

Dear sir : We very much regret that you are disappointed in the seed which we bought for you from a New York house of excellent reputation with whom we have traded for years. Are you not mistaken in saying that the sample sent is not orchard grass ? We have shown it to a number of farmers who have been in since the specimens arrived and they all pronounce it to be orchard grass.

The sample which was sent to the Station consisted of two very different grasses ; one was the old pest, *chess* or *cheat* and the other a really valuable meadow grasse—meadow fescue. Now notice that here is a firm selling grass seed and several farmers who are buying and using grass seed and both are calling chess and meadow fescue, orchard grass ; and here is a particularly sharp grass farmer who has got meadow fescue and chess mixed in his mind. I visited the field with him to see the actual state of things and found the two grasses named growing together, perhaps one-third chess and two-thirds meadow fescue with much less than one-tenth of the grass then in bloom, orchard grass. Of course the thing to do was to mow early so as to keep the chess from seeding and being an annual grass it would disappear and leave the fescue to itself. But a close examination of the sod also showed that he had a pretty fair catch of orchard grass into the bargain. The plants were only a few inches high. It looked as though the orchard grass seed had lain over a year without sprouting and last fall or this spring it had germinated and grown. This I think is very uncommon but not at all unheard of. I have had a seeding of grass lie in the ground a year and a half, and then when I had given it up and sowed another thing there, the old seed came up and inherited the earth and drove out the new seeding. It is well known that clover seed will lie in the ground for a long term of years, retaining its vitality and finally springing up and growing.

“What have you got there ?” said a friend of mine last haying time, leaning on the top rail of the fence as all leisurely farm critics should,—to a man in Norwich who was just going in to mow. “*Meadow fescue*,—new thing,” replied the other—but i

was a field chock full of chess that he was preparing to make hay of. This is the difficulty I am alluding to. Many of us don't know by sight our common grasses even when they are in bloom, much less, at all the other seasons of the year.

There are at least six conspicuous grasses, tall in bloom, which are to be found in almost every meadow of Connecticut. Most farmers would know three of them in bloom, comparatively few farmers know all six in bloom, and one could count on his fingers those who would know them by their leaves and stems any time during the growing season. These are Sweet Vernal, Kentucky Blue Grass, Orchard Grass, Meadow Fescue, Timothy and Redtop. There are a dozen or fifteen which are common and valuable in some parts of the State, but are quite out of the knowledge of most of us. Such being the case, will it not pay us all to follow Nebuchadnezzar and the most noble Duke of Bedford to grass—it is not a long journey to take—and study it, not as botanists but as farmers with the practical farm questions always in mind.

Here is grange work—woman's work in the grange. Each place must have some one with some knowledge of botany. Make such a person useful. Here are the waysides full of grasses. Every grange or farmer's club ought to be a place for naming specimens and talking over their characters and habits. Then why not have a village grass garden as a meeting place for those who are going to rule grass, instead of being ruled by it or by seedsmen? It won't cost us as much time and labor, as one might think, and, in bloom or out of bloom, grasses are the daintiest and most graceful of plants. By a grass garden I mean a collection of a dozen, or a hundred different species and varieties of grass, kept pure and distinct, a single sod or even tuft of each labeled, if there is no room for more, till every one knows them without a label, put where one can watch them in bloom and out, and so learn to know them, not only by their bloom, but by their general appearance, their roots, stems and leaves. More than this, to learn how they spread, how they winter, how they stand heat or drought, all those points that we need to know before we shall be masters of the grass situation and able to tell seedmen what we want and what we will not stand ; able to help ourselves if they will not, and raise our own seed.

A farmer ought to be able to recognize the common grasses not only when they are in bloom, but at *any* season when they are growing. It is not a difficult thing to do, and I hope our agricultural schools are teaching how to do it. There is an excellent little hand-book, McAlpine's "How to Know Grass by the Leaves," which will be a great help to any one who has a mind to help himself in this way. If my time were not limited and especially if we had some field of springing grass to walk and talk in, I should like to enlarge on this point and call attention to some of those differences which make it quite easy to recognize many of our common grasses.

So much for grass names and the recognition of the different species of grass by their looks.

Another point which I wish to bring out is this :

For farm use we have to regard different varieties of the same species of grass as well as different species. To illustrate what I mean, take the Indian corn. All Indian corn belongs to a single species, all of it is the *Zea maise* of the botanists. Yet see what a large number of varieties we have, the dents, the flints, the sweet and the pop varieties and under these any number of different sub-varieties having special requirements as to climate and special use on the farm.

We have a tall, coarse Red-top, with little bottom foliage, making fair hay, but not suited to pasturage at all. We have a much shorter, finer Red-top with more bottom foliage, that blossoms a week or more earlier, not perhaps adapted in most places for meadow, but one of the best, if not the very best pasture grass, a veritable peasant among grasses that stands trampling, close cropping and drought longer than most anything else. Then we have a still finer Red-top with leaves as fine as shoe-thread, never growing large, creeping under favorable conditions rapidly; the very thing for lawns, over which a child could walk bare-foot at any time, for it is as soft as a kitten's back—that is Red-top too. But it would be no more rational to sow this last for a hay crop than it would be to stick bushes for Tom Thumb peas to climb on. I have in my garden at New Haven, at least half a dozen of these Red-top varieties, picked up for the most part in the old meadows and pastures of that State.

These are varieties well-defined, constant, very unlike in appearance and in the uses to which they can profitably be put. No one in his right mind who knew anything about the varieties would seed a meadow with that kitten-back variety and put the coarse, strawy one into a lawn mixture. Seedsmen do the latter constantly and the reasons for it are many. They are not always in their right mind, generally they know absolutely nothing about the varieties, the only suitable seed is not to be got, the chances are that the lawn which is to be seeded is full of all sorts of weed seeds already, it will be top-dressed in the fall with stable manure full of timothy and red-top anyway and add to that the fact that unsatisfactory and run-out lawns make business brisk both for seedsmen and gardeners and you see that there is little inducement to sell anything but timothy, red-top, sweet vernal and rye-grass.

Seedmen will never know these varieties nor keep them till farmers demand them. Farm knowledge and grass-farm botany is what is needed.

Some years ago, I ordered from all the leading seedsmen in Boston, New York, and Philadelphia, samples of "Fine Bent" or "Rhode Island Bent." One of them had grace to say that he had not got it. All the others sent it. I planted each sample by itself. One out of the lot came true to name. All the others, eight or ten, as I remember it, were the coarse Western Red Top.

Now, Red Top is not alone in the number and striking differences of its varieties. Timothy shows a considerable difference also. I have heard farmers say that Timothy was not now what it used to be, and I believe a reason if not the reason is this: we used to seed our meadows with seed from the hay mows and bays and from the barn floor, *i.e.* with Eastern grown, *home* grown seed. Now we buy seed from western seed farms, farms run for the seed they will produce. The varieties which are likely to be raised on seed farms, which are likely to come in there by a selection, of which the owner of the farm himself is not aware, are not varieties which are most profitable for the Vermont feeder of stock to raise. At any rate I have heard it affirmed by farmers who formerly raised their own seed, but now buy it, that Timothy has changed; it

is harsher, more strawy and less leafy than it was years ago, and therefore not such good food for stock.

Before I go on, I want to say a few words more about the grass seed trade. It is a fact that seedsmen do not know what they are selling for grass, do not know the nature of the grasses and grass mixtures which they sell and for the most part are afraid to give any guarantee that the grass-seed they sell is even true to name. Not many years since a Connecticut farmer bought orchard grass seed and stocked down a large piece of land, hoping to have a permanent meadow, and he got a field full of so-called "perennial" rye grass, which with us is not truly perennial, and got just one hay crop from it. I myself have purchased orchard grass in New York, which did not contain a single grain of orchard grass. I have bought Annual Spear Grass, *Poa annua*, at three different times, and never got a spear of what I wanted. I believe Red Top and Timothy can be got true to name—not always good stock—but it is very difficult to get much, except those, true to name in market. Orchard grass seed contains often 30—40 per cent. of impurities and of the pure seed only from 30—40 per cent is capable of germination. It needs to be said that this is not altogether the fault of the seedsmen. Good seed costs more than poor seed, and the cheap seed is a good deal more popular than the expensive seed.

Not long ago, I was in an establishment where orchard grass seed was being cleaned and prepared for market. I saw some sacks which contained the dark brown clear seed free from the hull or husk that we always see in trade seed. It was heavy fine looking seed. The proprietor said he never sold that. Why, that was worth a dollar a pound. No one would buy it. It had no chaff and over 90 per cent. of it would germinate. He used it to mix with other lower grade seed again. Then I saw other bags containing mostly chaff, but that was not rejected—not a bit of it—it was used to "meet competition," i. e. if a dealer had got to have cheap seed this could be used to dilute better seed and so bring the seed within the reach of the poorest purchaser. But the point I am making is this: If we want cheap seed we shall get it. If we want and

insist on having *good* seed, we may get it, but we need not expect to get it at the same price as poor seed.

I have not given any opinion of the relative value of our different grasses. I am not giving any receipts for lawn-mixtures, for meadow or pasture seeding. It is not yet time for that and besides every seeds man in the land is doing it and every writer on grass in our agricultural press, for \$10.00 a column is busy with it and meanwhile our meadows and pastures are not growing better very fast.

What I want to impress on you is this. That farmers need to get acquainted with their grasses to know them by name and by their appearance the whole season through, to know their habits, their uses, their varieties. We need farm study with the cooperation of our Agricultural Stations and Agriculture Schools and Colleges. Until this is done we shall not be able to have it when and where we want it, to handle it intelligently and to have it permanent.

Well, where shall we begin? Some one says: It is all well enough to say what we don't know and haven't got, but where shall we make a beginning to get at something better? We are trying in Connecticut to begin in the nearest corner of our somewhat neglected pasture. So we sent a man, a farmer three years ago who was an expert over the old pastures of our state to pick up varieties of grass which seemed for any reason to have special promise and to be old residents there. A bit of turf 6 inches each way was a plenty, and these sods, shipped by express to us, we have cut into bits an inch or less square, set them out in our grass garden, kept them absolutely clean of other grasses and we are studying their turf making qualities and behavior under the scythe and grazing. Some of them will make sod at a rate that would surprise one who had not seen it done.

Bits of turf set 12 inches a part each way in six months have made a uniform sward over all the ground. These turfs we propagate *wholly* by cuttings. We do not let them seed for strong seed makes trouble in a grass garden. Moreover when we make cuttings we know that we are getting grass exactly like the parent sod. When we let it seed and use the seed we do not know what



the seedlings will be, how far cross-fertilization may bring in new and undesirable qualities. Just as when you bud or graft from a Seckel pear, you know your shoots will be true to name, but the seedlings from a Seckel pear may be unlike a Seckel or any other known variety. Grass varieties which are not the best we will throw over the fence but we hope and expect to get *some* very choice varieties, strains if you please, of these natural, peasant grasses, and when we have got them, and are sure of them, then have we not got a basis for a legitimate seed trade? Within two years of that time we can raise grass seed in quantity that we *know* something about, that is worth sowing and will grow grass that is worth having. We are trying also to help by making some grass-pictures that shall be for farm use. The best we have had hitherto are drawings of dried cabinet or herbarium specimens, which have their use to be sure, but they do not show the appearance of the grass as the farmer sees it standing by the roadside or in a head land.

But we need not sit down and wait for grass seed and pictures in order to greatly improve our meadows and pastures. I want to close with a few words on this matter, particularly regarding pastures.

You all remember the school-boy's composition on pins, which began. "Pins! Pins have saved a great many people's lives by not swallowing of em." If I were going to write an essay on plows I should want to begin. "Plows! Plows have saved a great many pastures by not plowing of em."

I believe the first general rules for making and keeping permanent pasture should be: keep your plow out and your cattle in. In former times farmers had perhaps too much reverence for old turf. They looked on it as the creation of a century. As Sinclair says: "a farmer, who wished to lay down a meadow in his youth, believed he must see the end of his three score years and ten before he could possibly possess a piece of pasture capable of keeping a score of sheep or a couple of cows. So much was the want of grass land felt among arable farmers in times past that the tenancy of it was eagerly sought, its value was consequently highly prized, and heavy fines were imposed for breaking it up. This was going

too far, but this generation errs in the other direction. We have not *enough* reverence for *old* pasture. Why, old *well kept* pasture is the millennium of grass. The unsuitable things have all perished, the fittest have survived and are living in peace but with tremendous energy. What this world will be when the things that work abomination and make a lie, are gone, when the unfit *i. e.* the unrighteous things, are perished out of it, that is what an ideal old pasture is for grasses. What your anarchist, socialist or Bellamy type of reformer is to society with his smoothing and leveling and starting over, that is what you are as a grass reformer, armed with a plow and stone drag and seed mixture for pastures.

And the Lord's way with pastures and with his world is the slow uprooting and killing out of the evil by the struggle with the good, in which a humble man who is very wise may help mightily, but neither a humble fool or a conceited wise man can do much.

Having said so much you see it is very dangerous for me to say any more. But isn't it perfectly true that what gives Vermont, New Hampshire, and Southern New England, their chance for the reputation of being the best dairy states in the country is the quality of their pastures? We can if we will keep a close sod in our pastures through the heat of summer, our land is well watered, and we have had till lately clean water for our stock also. Whether our brooks or streams are all to be made into open sewers for the convenience of our towns and manufacturing establishments, remains to be seen.

"Gilt Edge" butter requires in the very first place gilt edge pasture and that is what we have and what you may have here. All authorities agree that old pasture in good heart, stocked with our fine native grasses,—not bush pasture or pasture worn to the bone nor a pasture seeded with some seedsman's novelties—gives a flavor to butter and to cheese that nothing else can. This flavor is not a thing that every one can appreciate but it is appreciated and has a pronounced value in dollars and cents.

Wine makers know that a very old vineyard which has always been cared for makes a wine more delicate in flavor than can be got from a new vineyard however good. The reasons for this difference in the herbage of old and new pastures are easy to see. In

a new pasture you have a fight going on among the grasses and weeds for the possession of the land. The things which can stand crowding and grazing best, with the amount of moisture and plant food that the particular soil supplies are going to win and the other things are going to disappear. But during this scrimmage while some grasses are being slowly killed and others more hardy have not yet filled their places the pasture is not doing anywhere near its best. The forage is not as fine nor as sweet nor as hardy as it is later when this first struggle is over. Provided always that it is kept up and kept clean, pastured close enough and not too close. The pasture lot needs watching as well as arable land. It cannot be neglected without serious loss. I do not mean that it takes anything like the amount of *time* to tend it that a hoed crop takes, but sometime each year should be spent in tending it, otherwise it is sure to run to waste. If there is more pasture than can be kept up and well grazed, better put part of it into wood than have it die a lingering death and go first into bush pasture, then into bushes without pasture and be a torment to the town assessors and finally to the appraisers of your estate after your *own* death.

As to the seeding of pastures, reference is often made to the very large number of species of grass that are found in pastures. The number *is* large but it will be found that in any old, well-kept pasture nine-tenths of the grass belongs only to half a dozen species or less. A pretty careful study has lately been made of old English meadow and pasture with reference to this point. The results are interesting. The larger part of the weight of herbage belongs in many cases to a single species, and this with two or three others make up 90 per cent. of the grass in it. Examples will suffice. An old English pasture which had been in grass beyond the memory of any one, never mown but largely grazed with young stock, was examined with the following results. Of the entire herbage 90 per cent. was grasses, 1 per cent. legumes and 9 per cent. miscellaneous; 46 per cent. of the grass was a kind of red-top, 36 per cent. perennial rye grass, and 5 per cent. timothy, and there was a little velvet grass, sheep's fescue, crested dog's tail, etc. You will find that fine bent or furze-top, June grass or

Kentucky blue grass, sheep's fescue, flat-stalked meadow grass, and in damper places, rough-stalked meadow grass make up most of the grass of your pastures. Why then should we sow other things, that seedsmen recommend, tall red-top, orchard grass, sweet vernal and perennial rye grass, which is *not* perennial with us on a pasture? Sow things that we know or *think* will last, not those which we know will die.

A pasture will harbor weeds of all sorts, particularly if sheep cannot be kept on it. Some of the weeds impair or ruin the flavor of milk and butter and others simply stand in the place of so much grass—all of them are out of place. I do not propose to give specific receipts for subduing them, but it will help to keep in mind one or two things, and the chief one is, choose carefully the time of attack. A biennial, like wild carrot or parsnip can be kept from spreading by mowing off the flower stalks, but not killed; if its flower stalk is mowed the carrot will grow on and send up another next year. Its vitality is weakest just after blossom, and mowing it, *just before the seeds fall* will be most likely to destroy the original root. But if it is not too thick, energetic boys *in a wet time* when it comes up as if it were greased, will clean land very rapidly by pulling it. Sumach overruns land quickly. In the last few years I have had about 20 acres cleared completely of it in this way. When everything was frozen hard, temperature below zero and wages as near zero as they ever get, I had a man knock off the stems *close to the ground* with an ax or maul. They break easily when frosted and leave no sharp stubs to hold drifting leaves and bother noses when cows are grazing. After whipping in August with a whip scythe for two years the sumach is almost entirely eradicated.

I had a good deal of huckleberry bushes in the same pasture. They are harder to kill but they are being depressed by the same treatment and will I think be gone in a year or two more. Burning the piles of bushes on the huckleberry patches is a great help to this extermination. The fight is a great deal easier if the pasture is fed close. Then there are mulleins and bull thistles and other weeds of that sort. A common mullein will distribute 600,000, a bull thistle allowed to mature will distribute 10,000 or

more seeds over your pasture which beats the Seed Division of the Department of Agriculture all to pieces. But all that sort of thing is easily kept down by a small hoe which one ought to take with him whenever he goes over his pasture. It is no more trouble to carry than a cane, but with it alone you can maintain an absolute monarchy in a pasture which is decently clean to start with, or with some expenditure of time and pains it will clean a pasture of these weeds. You hoe up nothing with it. You simply strike the root below the crown and cut it clean off. Then go on. The sun will do the rest and show the slaughter you have done within an hour.

*Watch* your pasture. Go over it once a week if you can. It is rainy day work. If you salt cattle in pasture make them come for their salt to the spots which need their manure the most, they will be apt to make that a lying place and so make it richer.

To put together in few words the thoughts of to-day's talk:

Our meadows and pastures are capable of and require great improvement. We have on the one hand a market full of all kinds of grass seed and mixtures, none of which we are sure are good, and many we know are bad.

On the other hand we have here and there in our fields already the grasses which are best suited to our soil and climate but, we have not even commonly accepted names for most of them, the few names we have are somewhat indefinite.

Still fewer of them do we know by their looks throughout the growing season—and of the habits of these grasses, their mode of spreading, how they stand mowing or close grazing, how long they stay in the soil; of all this our knowledge is very small. It follows too that we have a great deal to learn of the *varieties* of grass; for a single species like Red-Top has strains or varieties as various in appearance and uses as those of Indian corn.

All this we must change. Our granges and farmers' clubs must be places for naming grasses and learning their uses. The Experiment Station should be called in to name doubtful ones. We have had sometimes a hundred and fifty specimens sent in, in one season, for identification at New Haven.

The station can co-operate by receiving, cultivating and study-

ing varieties that promise remarkably well, propagating from the root and when the merit of a variety is established sufficiently to warrant it, raising seed from it and testing it on a large scale.

In this way we may in time bring a reform in the seed trade. Any farmer who will take the time can do this work as well as the station perhaps.

And finally I plead for our old pastures with a solid turf, that we give the turf which has been establishing itself for years and has already got the enduring grasses in it, a chance by clearing it of bushes and weeds and saving it both from the plow and from neglect.

It is no time to kill old turf when we are so densely ignorant of how to get new turf as good.

## HIGHWAYS.

---

A lecture delivered in the Farmers' course at the Agricultural College by V. G. BARBOUR, Professor of Civil Engineering.

We take a just pride in our system of railways, which intersect the country in every direction, and are so well adapted to the work they have to do. They bring all classes into such close communication with each other that our lack of good wagon roads has attracted less attention than it otherwise would. But if our railway system is the equal of any in the world, our wagon roads, if not the poorest, are far inferior to those of France, England, Germany, and other European countries. During the last few years, however, an increased interest in the improvements of our common roads and of city streets has arisen. The press has done much to call attention to our deficiencies, and in many of our papers and magazines have appeared also articles setting forth the principles of good road building. If you have read them you will recall that familiar but none the less true proverb that the roads of a country are a measure of its civilization. Some of them call attention to the much more important fact that they are not only a measure but a promoter of civilization.

Why are the farms in the neighborhood of cities and larger towns more valuable than those equally productive, but more distant? Is not one reason and a most important one, that for the nearer farm the cost of the transportation of hay, grain, wood and other farm products to the town, and of fertilizers and the various supplies needed for the farm, from the town, is not so great a burden as for the one more remote.

With really good roads the farmer six miles from town or the railway station would find the cost of this transportation no more than one now only three miles away. It would be interesting to study the location of the abandoned farms of Vermont, of which

so much has been said. I have seen some of them but they were all in regions remote from railways and large towns.

From many careful experiments it has been determined that the force necessary to draw a given load on a level on a good broken stone road is less than one-third of that required to draw the same load on a common earth road, and on a well made and maintained broken stone road the force required is less than one-quarter of that needed on a common earth road. Beside the increased comfort in riding on a good road, there is then a considerable saving in the actual expense of hauling a given load. But good roads have more than a commercial value.

One writer says : "The present strongly marked inclination of our farming population towards cities, which is so often regretted, would be checked doubtless by an improvement in the condition of our roads. How often do we see our farmers, especially the most prosperous and intelligent ones, who are wise enough to wish to educate their children well, moving to the smaller towns and cities, often a distance of only three or five miles because their children cannot otherwise be regular in attendance at school and secure the advantages of social life. How much better in every way, both for the farmer and the country at large could this real need, the recognition of which is highly creditable to the farmer, be met by good permanent roads that could be traveled with speed and comfort in all weather and at all seasons. A still greater benefit would doubtless be received by those who are unable to take up their residences in town, or who have not the worthy ambition for their children's advancement that would lead them to do so. A large part of the mental inspiration and culture of the farmers depends upon their ability to attend church, lectures, concerts and social gatherings at a distance ; and really good roads by enabling them to go so much more easily would doubtless raise the whole intellectual tone of the farming community, besides keeping within the healthful influences of the farm many who now are almost forced into the towns."

You will hardly expect that in the limit of this lecture I shall be able to give you such instruction as will make you competent road builders. The variety of questions to be considered, and a



certain technical training necessary to the right understanding of many of them prevents this, although the subject is not especially difficult to understand, and the principles thereof have been pretty definitely ascertained.

But I wish to call your attention to some of the more obvious defects of our present roads, and to some of the causes of these defects, and to suggest some improvements which may be made in their care and management. In many of the countries of Europe, everything connected with the construction, the use, and the maintenance of roads has been the subject of exact observation and experiments, many and varied in their character. We have the results of these many years experience and the principles of road building have been so definitely ascertained that the main improvements in this work in the last fifty years have been in the machines and tools used.

Most of our roads are simply earth roads, that is, roads whose surfaces are formed of the natural soil covering of the territory through which the road runs. Their condition under travel varies with the season in a measure, and especially with the amount of water contained in the soil. Except in sandy soil the surface of the road in summer weather is commonly so hard and compact as to resist the action of the feet of animals, or the bearings of the wheels, and travel may be carried on with comparative ease. But when the material forming the surface of the road is filled with water, the adhesion of the particles to each other is destroyed, and they slide over each other under the pressure brought upon them, and the whole is soon reduced to mud into which the wheels sink, and which offers considerable resistance to the traffic.

Where the soil is of a clayey nature, that is where the grains of which it is composed are very fine, and so hold considerable water between them by capillary attraction, the depth of mud may be greatly increased by the action of frost.

The contained water expands as it freezes, pushing the particles as under and destroying all the adhesion which had tended to grow up among them, with the result that as the frost disappears, leaving the texture of the ground loose and so admitting the water

readily more copiously and to a greater depth, it is even more incapable of bearing up the wheels.

To improve clay roads then they must be effectually drained so that the least possible water will remain in them. Deep side ditches are necessary for such roads, and the narrower the roadway the more effective will be the drainage works. Hence such roads should have no more width than is absolutely necessary for the traffic upon them. The shape of the road surface should be such that the water falling upon it will flow off readily into the side ditches; that is, it should be higher at the center than at the sides. There has been some discussion as to the best form for the transverse or cross-section of the road surface. It has been proposed by some to make it the segment of a circle, and this form is given it by many road-builders. This form, however, leaves the road quite flat at the center, and gives considerable slope at the sides. Hence all the travel seeks the crown of the road, and the portion which was already nearly flat soon becomes so worn down by the travel as to retain the water which falls upon it, and form a channel in which the water runs along the road instead of into the side ditches. By others the cross-section is formed by two straight lines sloping each way from the center, and connected at the center by a short curve.

The slope of the lines should vary from 1 in 12 to 1 in 30, the greater slope being given to rough surfaces. On the clay roads of which we have been speaking the slope may in general be about 1 in 18.

When we have cut deep side ditches and put the surface in proper form, we have done the best we can do for *clay* roads. These ditches should be from two to three feet deep, and in general the material excavated from them may be used to raise the surface of the road above the level of the adjacent land. The ditches should be about a foot wide at the bottom and have sufficient slope to their sides to prevent the soil from slipping into the ditch, and they should be kept open so that the water may have an unobstructed flow through them to the natural water ways. Their office is both to cut off, in some degree, the water of the soil adjacent to the road, especially in sloping ground, and to allow that already in the road bed to drain away. The first office is quite an important one,

since if the road bed is properly shaped, most of the water falling upon it runs directly into the ditches, and the soil of the road bed remains comparatively dry if the water of the adjacent soil is cut off. If there are springs in the road bed which are not cut off by the side ditches, they should be connected by under drains to these ditches.

In some cases, for example on roads built upon steep hill sides, and with sharp eurvature, the form of the cross section may well be varied for the safety of travel from that before described. The outside of the road may be made the highest, and all the water falling upon it turned into the ditch on the upperside of the road. In this case the ditch is especially needed to cut off the water from the soil of the hill above, and if the whole of the road surface inclines toward this ditch, the foot hold of the horses is more secure and travel is safer.

While the portion of the road between the side ditches should be as narrow as convenience of travel will permit, a wide space outside of the ditches should be kept cleared of trees, bushes and other vegetation, so that the sun and wind may be able to exert their drying power to the utmost.

Sandy roads require somewhat different treatment. They also should be narrow, those being best where the wheels are confined to a single track way. No side ditches, or only very slight ones, are to be built. The trees, bushes and grass are to be encouraged to grow as much as possible, both to assist in retaining moisture in the soil, and to assist by their roots in binding together the grains of sand. The grass should be permitted to grow close to the wheel tracks, and between them and the track for the horses. Repairs of such roads should not be made by ploughing them up and shaping their surfaces. But their surfaces should be disturbed as little as possible, and repairs should consist largely in filling up the ruts with suitable material, as coal ashes or gravel.

Sandy roads can be very much improved by a dressing of four or five inches of clay. Clay roads also are much benefited by a coating of sand or gravel. Vegetable matter, as shavings, etc., may sometimes be used to advantage on clay roads, and one writer says, that in Northern Minnesota excelsior has been used with good

effect. The rapid decay of such substances prevents the benefit derived from their use from being permanent. But the best of earth roads are for a large portion of the year but a poor substitute for good *permanent* roads. They are generally unfit for use at the very time it is most convenient for the farmer to use them, that is in a rainy and wet season when the team cannot be used on the farm. The surface of a road should be hard and free from mud and dust. About the beginning of this century John Loudon McAdam proposed to cover the surfaces of roads with angular pieces of broken stones. The principles which he developed have been improved upon but little, and the service which he rendered to men by their development has been commemorated in the name macadamizing, which has been given to this sort of road improvement.

McAdam called attention to the fact that if smooth rounded stones were used on the surface of a road they would not pack together, but were continually dislodged from their positions by the feet of animals and the blows of the wheels. They could to be sure be bound together by a certain amount of binding material, but the adhesion of this material to the stones was uncertain and greatly diminished by moisture and frost. But he showed that *angular* pieces when crowded together will adhere to each other and form a solid mass, especially if the stones are tough and do not break. He showed also that large pieces of stone are more liable to be displaced than smaller ones. That is, a wheel striking a stone four or five inches long near one end, tends to throw the other end out of place. He proposed therefore to cover his roads with stone broken into angular pieces, none of which should exceed two inches in length. He had the stone broken by hand. The weight and shape of the hammer to be used were specified, and inspectors tested the sizes of the broken stone. The smaller the pieces of broken stone the less the tendency to be displaced by the traffic, hence, the pieces should be as small as can be used and not crush under the traffic. The hardest and toughest stone may be broken more finely than the less hard and tough. This kind of road grew rapidly in favor, and even good stone pavements were torn up and replaced by the broken stone. The broken stone covering was laid on with a thickness of about twelve inches at the

center of the road, and six or eight inches at the sides. It was put on in two or three layers, each layer being subject to the traffic for a time sufficient to consolidate it. The lower layers not being subject to the permanent traffic were of larger pieces, and could be of softer stone than the last or upper layer. The surface of the earth road way upon which the broken stone was to be placed, was first graded to proper shape, then a layer of about six inches of broken stone was spread upon it and the road was opened to traffic. When this layer had become consolidated, another layer of finer material was laid on the first, and this also was consolidated by the travel. Then the final coat of the finest and most regular shaped pieces was laid on. McAdam insisted that the broken stones should be kept free from mud and dirt so that they should be held in place by the adhesion of their edges against each other. The principal improvement upon McAdam's methods have been in having the stone broken by machinery instead of by hand, and the road bed consolidated by rollers especially designed for this purpose, rather than by the traffic. The great advantage of the latter improvement is evident when we consider how narrow are the tires of most wheels, and how little adapted they are to the work which they were required to perform in the consolidation of the road bed. Even yet it is difficult to persuade people to adopt the cheaper and better method since it calls for a direct outlay, while the old method although much more expensive and less effective, is an *indirect* tax upon them.

At the same time that McAdam was building his roads in England, another engineer was improving the roads of Scotland. Thomas Telford was appointed in 1803 engineer for the construction of about 1000 miles of road in the Highlands of Scotland, a good part of which traversed very difficult country. He employed most of the principles of McAdam but believed that good permanent roads could not be made by placing the broken stone directly upon the soil forming the road bed, since the soil being compressible and variable in its character, would permit of unequal settlement of the broken stone covering and thus destroy its smoothness and compactness. Telford therefore placed by hand a bottom course or layer of stones in the form of a close pavement upon a

level bed prepared for the road material. The stones set in the center of the road were seven inches in depth, but those at the sides only four. They were set on their broadest edges and lengthwise across the road, and the breadth of the upper edge did not exceed four inches in any case. All the irregularities of the upper part of this pavement were broken off by the hammer, interstices filled with stone chips firmly wedged or packed by hand or a light hammer. Upon this pavement the broken stone was placed in two layers, the first layer being about four inches thick and somewhat consolidated by travel before the final coating of two inches was placed upon it. The sub-pavement could be of an inferior quality as it was not subject to severe wear and tear, but the toughest and hardest materials were needed for the top layer of broken stones. The only advantage gained by placing the pavement on a level bed was the expense saved by the opportunity thus furnished for using smaller stones at the sides in giving the upper surface of the pavement the proper convexity of cross section. A better drainage of the road bed would doubtless have been secured by giving the soil the same convexity as that of the finished surface of the road, and forming the pavement of the same depth throughout. The advantages and disadvantages of the sub-pavement or bottoming, which is the characteristic difference between the Telford and McAdam roads, have been the subject of lengthy discussions between the advocates of these two methods. Some of the defects which the advocates of the Telford system impute to a road of broken stones laid on earth (especially clay) without the sub-pavement, are first, that the lower stones being small are easily forced into the earth by the weight of the wheels, and that this mingling of earth with stones forms a loose and open mass which will not compact; and second, that the water which penetrates the road covering in winter does not drain away but freezes and breaks up the; third, that no thickness of broken stone will thoroughly road destroy the elasticity of the soil.

McAdam maintained that thorough drainage would prevent all these evils. It is certainly necessary that in order to be permanent, roads should have a stable and firm foundation. This is furnished by the sub-pavement of Telford, for by it the pressure

of the wheels is distributed over a large space, and the pavement acts as an under drain to carry off the water which may find its way through the broken stone surface. When the stones are properly set and wedged with stone chips they will never rise to the surface. The broken stone being on an immovable and dry bed, do not mix with the soil and become perfectly united together. A road thus constructed will in many cases cost less than one made entirely of broken stone, for the bottom or pavement may be of any cheap and inferior stone which will bear weight and not be decomposed by the atmosphere, but which would not be sufficiently hard and tough for the broken stone covering. The total amount of stone employed will be no more than would have been required for a road made entirely of broken stone, and the cost of hammering and setting these stones would generally be less than that of breaking an equal mass. But even if such roads cost more at first, they are often cheaper in the end, for besides being more compact and smooth, stones laid on such a pavement last much longer than those laid on earth, and the expense of keeping the road clean is also less.

Since it is so desirable that the foundation for the broken stone should remain compact and immovable, it is now generally required that the soil itself of the road bed should be well compacted by a heavy roller before the stone is placed upon it. There can be no doubt, that for the making of good McAdam or Telford roads a good steam road roller is essential. Some of the best of these are made by Aveling and Porter. They are made of steel and weigh from ten to twenty tons, costing from \$3,600 to \$5,500. Those weighing twelve or fifteen tons are more generally used. The cost of running them, including fuel and driver or engineer, varies from \$3.00 to \$5.00 per day. They can be used on almost any grade and travel from two to seven miles an hour.

Machines for breaking the stones are also made, which may be driven either by steam or water. They are of various sizes or receiving capacity, the smaller receiving pieces of stones six inches by two inches, and the largest pieces eighteen inches by twenty-four inches, and capable of producing from one to ten cubic yards of two-inch pieces per hour, and costing from \$100 to \$1,000. A

common size receives stones fifteen inches by nine inches, and produces about eight cubic yards per hour. The machines are furnished with an automatic revolving screen into which the crushed material is delivered, and separated into several classes as sand or powder, pieces about one inch on a side, those two inches on a side, and the larger pieces or tailings.

While the bottoming and lower layers of stone may, as has already been said, be of inferior stone, the surface coating which takes the traffic should be of the hardest and toughest that can be obtained.

Trap rock being both tough and hard is generally considered the best for this purpose; next to this is granite, then comes limestone and sandstone. It is often more economical in the end to procure a supply of the tougher and harder stone, even at a considerable increase in the price per cubic yard. Thus on a road in Baden which was at first macadamized with rock costing only fifty cents per yard, it was finally found cheaper to take harder rock from a distance costing \$1.78 per yard, the saving being both in less quantity of material used and less labor required in repairs, and the harder material also furnished the better road. In London where there are 1,500 miles of broken stone roads, the stone is brought 150 miles, and when delivered ready for use costs \$4.25 per cubic yard.

To recapitulate what has been said in regard to the construction of Telford and McAdam roads:

1st. The earth road bed on which the stone is to rest, is to be excavated to the required depth and graded and shaped to its proper form. Then it is to be thoroughly and repeatedly rolled with a heavy roller, all depressions which appear being filled with the same material as the road bed and rolled until the whole is compact and firm. Too much attention can not be given to the careful preparation of the road bed. It is not sufficient that it be simply smoothed over and then built on; it should be heavily rolled until it is *uniformly* compacted, otherwise the surface of the broken stone will soon follow the unevenness of the sub-way. It is not well to plough up the road bed, since the depths reached



by this means are irregular, and uniformity of compactness is more difficult to obtain.

2d. On the road bed thus formed and compacted a paving of stone eight inches at the center, and six inches at the sides is set by hand. The stones are laid with their largest side down in parallel lines across the street, breaking joints as much as possible. The width of the upper part of the stones should not exceed eight inches or be less than four inches, and they should not exceed fifteen inches in length. After being set closely they are to be thoroughly wedged in position by inserting between them stones as nearly as possible of the same depth. To accomplish this a bar is inserted between the stones and they are pushed apart to receive the wedges. No wedging is to be done within twenty feet of the face of the work. Projections of the upper part of the pavement are to be broken off, the small interstices are to be filled in with stone chips firmly wedged with the hammer, and the whole to be thoroughly rammed and settled in place. By wedging the stones and filling in with smaller pieces the foundation can be made unyielding and firm, and still be sufficiently open to afford good drainage. Almost any quality of stone will do for this course, and once properly laid it needs no renewal.

3d. On this pavement should be laid a layer of broken stone, varying in size from three inches on their greatest to one inch on their smallest diameter. These irregular sized stones may be the tailings of the screened stones, or may be raked from the quarry and placed on the road bed without being machine broken, but they should be clean broken stone, free from dirt and within the dimensions given. This course should be about four inches in depth at the center and three inches at the side, and should be rolled until it is thoroughly compact and solid. A small quantity of binding material will generally be needed to fill up the crevices and make the course solid. The binding material should be fine screened gravel or sand, and it should be watered sufficiently to prevent the road material from adhering to the roller. Stones of irregular size may be used on this course since it is not subject to the wear of vehicles, and stone of inferior quality may be used if it will not crush under the roller. The watering must not be in

such excess as to wash the binding material through the layer of stones.

4th. On this course should be laid the surface layer of broken stone. It should be from two to three inches in depth after it is consolidated. The stone should be uniform in quality, and as nearly cubical in form as possible. They should not exceed two and one-half inches in their greatest dimension, and stones which are wedged-shaped, or do not approach uniformity of measurement on their sides should be rejected.

No stones should be allowed to remain upon the road which are not sound, strong, equable in size. They should be raked into an even layer and the roller passed over them two or three times. After this a quantity of clean sand or fine gravel is thrown on and sprinkled with water until it is sufficiently moistened to prevent adhesion to the roller. The rolling is then continued, working the roller back and forth gradually from the gutter to the crown, with occasional light waterings until the cross section is of the shape required, the roadway compact and solid and all excess of binding material removed.

The stones of the upper layer should be the wearing surface of the road, and the traffic should come in contact with them. Gravel or dirt remaining on the roadway will increase its wear and tear. Long experience has shown that the oftener the streets are cleaned the less is the mud which is created and removed, the attending expense is not increased and the roads are in a better condition. The worn particles if left on the surface act as a grinding powder under the wheels to reduce to similar powder the surface of the road. Hence no top-dressing should be placed on the upper layer of stone. The fine screenings from the broken stone may be used for binding material when a saving of expense can be thus effected.

This method makes a durable and first-class Telford road costing from \$8,000 to \$10,000 per mile, for a roadway of sixteen feet in width. Many roads are built with less care and expense. If the road bed be dry it may be so compacted by rolling that the Telford pavement may be omitted and only a layer of broken stones compacting to four inches in thickness placed on it. Such

roads have proved themselves very serviceable in many places, especially where the traffic is not heavy and the stones of a good quality. They will not bear neglect, but require a constant and careful supervision so that at the first appearance of a weak spot it may be repaired. The cost of such roads is about \$3,000 per mile, and while the expense for repairs would be somewhat greater than for the more substantial Telford roads, they would doubtless be satisfactory for many of our country roads if built and maintained under careful supervision.

#### REPAIRS.

There are two methods of repairing broken stone roads. By one method the broken stone is permitted to wear down gradually and so far as possible evenly, no work being done upon it except such as may be necessary to preserve the evenness of the surface by filling holes and incipient ruts with small quantities of stone not rising above the general surface, and therefore not intended to restore the surface to its original height. When the road covering is worn down to a depth of about three or four inches, a thorough repair is made by applying sufficient material to restore it to its original thickness. The season of least traffic is selected for this work, and in order to lessen the interruption of travel, the roadway may be covered and rolled upon only half its width at a time. The relaying and rolling should if possible be done in wet weather, at least the new material should be well moistened that it may thoroughly unite with the old. This union is more readily effected if the old surface is first loosened by picks. The steam road rollers have an attachment which can be placed on the rollers and by which the work of at least fifty men with hand picks can be done in one day. This method of repair is called the periodic method of repair, and is used only on streets in or near cities upon which the traffic is heavy.

— The best method of maintenance and repair of country roads is by the *constant* method of repair; that is, the road is always undergoing repairs in order that no necessity for making *extensive* ones may occur. Every road should be divided into parts of suit-

able length, on each of which should be placed a person who understands his business, and who should attend constantly to the proper state of the road, and for which he should be held responsible. His work should be to keep the road always scraped clean and free from mud, to fill the ruts and hollows the moment they appear with broken stone, which should be kept in piles along the sides of the road at intervals of 600 or 800 feet. He should be supplied with a wheelbarrow, shovel, pickaxe, scraper, stiff broom and rammer. The length of road which one man can care for will depend on the width of the road bed, the amount of traffic and the quality of the material of which the road is built. During the spring and autumn when the surface is soft, and more work is necessary, additional men may be employed under the orders of the permanent laborer, but not in such a way as to relieve the latter of his responsibility for the good condition of the road at all times. The wear upon well-built roads is slow, and if the wagons be prevented from following in each others' tracks, very even, a condition of things which can be maintained only by careful watching. The new material should be added little by little, from time to time, in the depressions and deficient places, and should be broken fine, the largest pieces not exceeding one and one-half inches in their greatest dimension. The method is one of patching and it should be done so constantly that the small patches of broken stone will never exceed one or two inches in thickness, and they should not be large, not more than six to ten feet on a side, and they should not be too close together. When these patches have become solid then other depressions may be filled and so the whole surface gradually renewed.

It may seem as if this system of making repairs would be expensive, but actual statistics show that in proportion as the intervals between the periods of repair are shortened upon roads of small traffic two important and valuable results invariably follow : 1st, the annual expense is lessened ; 2nd, the roads are always in better condition and the roads are never so good nor the expense of maintenance so small as when the system of constant and minute attention is in full operation.

In filling holes the bottom of the same should first be swept

clean of mud, then filled up level with the remainder of the road. Long ruts or wheel tracks are not to be filled up their whole length at once, but only short pieces at a time. If this precaution is neglected vehicles avoid such places and new ruts are formed elsewhere.

So far nothing has been said concerning the laying out of roads, that is, about their alignment and grades, nor concerning the building of embankments, culverts, drains and bridges. There is time only to call attention to the fact that a most serious defect of many of our country roads is their poor alignment. They clamber over hills which they could so much more easily have gone around. One reason of this is that the houses of the first settlers were usually placed on hill tops, and the first roads were naturally run from house to house, and we have continued in many cases to follow these primitive roads. A good road should wind around the hills instead of running over them, and this it may often do without at all increasing its length. The difference in length between a straight road and one slightly curved is very small. But even if the level and curved road were much the longer, it would almost always be better to adopt it, for on it a horse could safely and rapidly draw his full load, while on the other he could carry but a part.

Up a slope having a rise of one foot in a hundred feet, a horse can draw only .9 of the load which he can draw on a level; up a slope with a rise of two feet in one hundred feet, he can draw only .8, and up a slope of 5 feet in one hundred feet he can draw only .4; and up one of ten feet in one hundred feet, only one-quarter of the load he can draw on a level. It follows therefore that it is very important never to allow a road to ascend and descend a single foot more than is necessary. As a general rule the horizontal length of a road may be advantageously increased, to avoid an ascent by at least sixteen times the perpendicular height saved, that is, we may increase the length of a road at least 1,600 feet to escape a hill 100 feet high.

If a hill is to be ascended the road up it should nowhere have even the smallest fall, but should be so located as to secure a gradual and uninterrupted ascent.

Some remarkable improvements in this respect of old roads have been made by good road makers. A road twenty-four miles in length in Wales, which rose and fell a perpendicular height of 3,540 feet was re-located by Telford so as to rise and fall only 2,257 feet, and the new road was moreover two miles shorter than the old. Another road in the state of New York connecting two villages, one 800 feet higher than the other, had such rise and fall that an ascent of 1,200 feet had to be made in going from the lower to the upper, and 400 feet in going from the upper to the lower. The new road was so located as to have practically a continuous fall.

It seems to me that we must conclude from what has been said in regard to locating, constructing and maintaining roads that this work can properly be done only by men familiar with the principles involved and of practical experience. Such men should be employed and paid such adequate salaries as would permit them to give their entire time to this special work.

No railroad company would think of employing to lay out, construct and maintain its roads, men no more familiar with the principles involved than those ordinarily employed for this purpose on our wagon roads. The railroads find it profitable not only to employ trained men in the work of supervision, but so far as practicable to do the same with respect to the foremen of gangs of workmen, and they find that experience and training make even the ordinary laborer more valuable than he would otherwise be. But in the care of wagon roads these principles are generally disregarded. Not only are the men to whom their care is committed generally ignorant of the proper method of doing the work, but the time for which they are called upon to perform this service is generally short. This year one body of men have the roads in charge, next year another body will have them to care for. So that what little experience may have been gained will be lost, and there is no possibility of forming and carrying out any comprehensive plans for road improvement. In some of the states the road commissioners say frankly that they think one-half of the tax expended for roads is wasted, not to speak of that which results in a real detriment to the road. The care of roads, it seems to me, should be placed in

the charge of a body of men more permanent in its character than that now having their care. Such a body of men should employ some expert and competent man to direct all work done in connection with roads and bridges. He should report to them upon the state of the roads, their grades, character of the soil, methods of and cost of improvements, and the result of the work done upon the roads from year to year, and he should be held responsible for the results attained. I believe Governor Claffin was right when he said: "It may be found upon investigating the cause of our miserably poor and ill constructed roads that the laws relating to this subject need revision." Clemens Hershel says in his essay on road making, "The fault lies in the machinery of government, originally built up to cater to the wants and needs of a newly settled country—a colony breaking a path through the wilderness, it has long since ceased to satisfy the demands of the present State in no matter so essentially as in that of its government and laws relating to common roads and highways."

This is a subject requiring special knowledge to be acquired by long experience or the shorter method of imbibing the experience of others, which on analyzing it, is all that any study amounts to; formerly it was not so, and most anyone sufficed to make improvements on Indian paths. We need now expert knowledge on this point.

Since, then, I believe that no great improvement in our roads is possible until some improvement in the laws relating to their management is made, I shall ask your attention during the remainder of this lecture to the consideration of this *fundamental* problem.

A most interesting pamphlet was published last year by the American Economic Association on this subject entitled, "Road Legislation for the American States." I shall quote it freely, and wish you might all have opportunity to read the whole of it. Let us make some examination, first of the methods by which some of the older countries of Europe have been led by their experience to manage their roads. Many Americans believe, doubtless, that in matters relating to the form of government, political theories, etc., we have little to learn from the nations of Europe, except by way

of shunning their examples, while they have much to learn from us. In purely administrative matters, however, is it not reasonable to conclude to their methods are superior to ours? Surely experience is doing much for us in his respect; doubtless it has done much for them. Of course, as we shall see in the case of road laws, many minor changes are usually needed to adapt their plans to our circumstances.

France has doubtless the most complete system, and the best roads in Europe. Capt. Greene, in a late article on roads, says her roads have a length of over 200,000 miles, of which more than half or 120,000 miles are macadamized. These roads are divided according to importance into national roads, departmental roads and local roads. The national roads are the great highways which lead from Paris to different points on the frontier. At the beginning of the century these high-roads were almost the only ones kept in good repair; and were for many years the main arteries of traffic and travel all over France. But since the establishment of railways, they are much less used. This class of roads is entirely maintained by the State, and is under the management of State engineers, whose chief is the Minister of Public Works. The departmental roads connect the different towns of a department with each other, and with the towns of the neighboring departments. They are maintained out of the funds of the department, a territory corresponding most nearly to our county, and they are under the direct management of the County or Department Council. The local roads are divided into three classes, the important roads, the ordinary roads and the by-roads.

The important local roads are considered as nearly equivalent to the departmental roads, but are almost all of more modern construction.

In many departments, the departmental roads and the important local roads have been completely amalgamated; in others they are still managed by different staffs, but always under the authority of the County Council.

The ordinary roads are of less width and less solid construction than the preceding, and connect together the principal villages of a canton. They have been generally made up out of old village



roads which have been repaired, widened and straightened under the direction of the county officers. They are kept up mainly by parochial contributions, but the county gives considerable help, in the form of annual grants, which are variable and voted every year. The by-roads are the purely parochial roads, maintained out of the resources of the commune. They are under the supervision of the mayors of the communes; but the county officials almost always lend their assistance or advice when required.

The supervision, the repairing of all these roads, and the construction of new ones, require, of course, a considerable staff of officials, which the County Council are free to organize as they think fit. In some departments the old departmental roads have been left in the hands of the State engineers, whereas the other roads are confided to a local staff, called the parochial service. In other cases, the whole of the roads are managed by the State engineers, who receive on that account extra pay from the department. But in most cases the County Council have entrusted the whole network of county roads, great and small, to their own officials of the parochial service, paid entirely out of the county budget, and under the direct control of the county representatives, who could stop their pay if they had any serious cause of complaint.

At the head of the parochial service is the roadmaster-in-chief, who is sometimes an engineer who has left the service of the State for that of the department, sometimes a man who has distinguished himself in the parochial service. Under him there are several roadmasters of arrondissements, and in each canton one or two roadmasters of cantons, according to the size and importance of the canton. These latter agents have under their orders a large number of "cantonniers," who are attached permanently to the different roads and execute all the current minor repairs; when these are not sufficient, other workmen are engaged temporarily. The roadmasters now form a considerable body of skilled men all over France; they are regularly trained in the art of constructing and repairing roads, of making the best use of the very variably materials at their disposal; their methods are embodied in regular hand-books, and all questions connected with their profession are

discussed in a monthly review ; many of them have become excellent practical engineers. A special budget for the roads is prepared every year by the roadmaster-in-chief, and laid before the County Council. It is divided into two sections, the first comprising all the annual repairs ; the second relating to the reconstructing of old and ill-constructed sections, the straightening of sharp curves, the lowering of steep gradients, or the construction of entirely new roads.

This is much the same system of constant inspection, maintenance and repair which is in use on every one of our principal railroads, but which is never applied to our wagon roads.

Belgium and Italy follow in the main the French method. In 1867, Italy by a special grant to the provinces, made great improvement in her roads. The roads of the provinces were divided into three classes, for the improvement of which the State agreed to assume respectively three-quarters, one-half and one-quarter of the expense.

In Prussia and the German states, generally, the roads are divided into at least three general classes : 1st, state roads, or those of the most general significance for the state as a whole ; that is, the military roads and those connecting the large market towns. From early times these have been built and supported by the state, and managed by state officials. 2d, provincial roads, or roads connecting, the main roads being their principal feeders. They are supported mainly by the province with aid from the state treasury if it is necessary or advisable.

For the extension of these roads, there are certain funds contributed in part by the province concerned, and in part by the state, and in some cases there is also in addition the income from tolls levied by the state. In the administration of this fund the provincial representative board unites with the state officials. 3d, local roads, of different degree of importance of course, but strictly local in their service. These are supported by the village or district, and are controlled by the local authorities. In many cases a road of one of the more important classes in part of its route fulfils the function of a local road, and in that case the local body is expected to pay its due share for its support.

In England may be seen also the same tendency towards classification of roads and centralization of administration as on the continent, though on account of the tendency to hold to old forms, that is so strong in England, the administration is more in the hands of the local authorities. The tendency towards the classification of roads, appointment of skilled road makers, support of the roads by larger subdivisions, as on the continent, is very marked of late years; and especially noteworthy is the assumption of the control by the public of roads formerly managed by the Trust Companies. The development of the system in England is well worth following at some length.

In the middle of the 18th century, the roads were in a scandalous condition, rendering communication between different places very difficult. To relieve the country in this respect the turnpikes were established, built and managed by the Turnpike Trusts. These roads gradually spread all over the country under the authority of hundreds of special acts of Parliament, until in 1840 there were in England and Wales 104,772 miles of turnpike roads. The opposition to the tolls led in many places to rioting, and the wastefulness and expense of maintaining the system in later years became very evident. In 1871 the census showed that some 5,000 persons in England and Scotland were engaged in collecting tolls, showing that from twenty to twenty-five thousand individuals were supported in this way. These expenses absorbed a large share of the revenue, and the other expenses superadded were so out of proportion to the receipts that many of the trusts were hopelessly involved in debt, unable to pay even the interest. For the past 25 years much has been done in the way of relieving Great Britain from this nuisance. As early as 1857 or 1858 Ireland freed itself from all toll gates.

Scotland, by an act of 1878, was freed from all tolls not later than 1883, and England has abolished them by the hundreds, and will doubtless soon be free of them altogether. The effect of England's toll legislation has been given that we may profit by her experience.

The legislation in England regarding the roads supported by the public, at first, was of the simplest kind—the town or parish

being made the administrative unit. By the act of 1835 provision was made for uniting, on their petition, several parishes into one highway district, for a period of three years, or at the will of the parishes, by act of the justices at quarter sessions. Each parish was to be represented in a district board by a member elected by the parish, and a district surveyor was to be appointed to have charge of the roads of an entire district. The money raised in each parish was to be expended on its own roads, unless by its special permission. Even the salary of the district surveyor was thus paid piecemeal. The district, it will be seen, formed thus a more convenient unit of administration than the parish in some respects, but the burden of support was not changed at all.

The supplementary acts of 1862 and 1864 extended the power of the justices in consolidating parishes into highway districts, thus making it eventually the common practice. The highway board, elected by the parishes became a body corporate for the district, the district being now recognized as permanent. In 1862 the salaries of the officers, and other common expenses, were to be divided among the parishes "in proportion to the average of the expenditures incurred during the last three preceding years in such parishes respectively in maintaining and keeping in repair the highways thereof." The expenses of making and repairing the roads, however, were still borne by each parish independently. In 1864 an advance towards unity was made, in that the common expenses were now paid out of a district fund contributed by the several parishes, not in proportion to their road expenses, but in proportion to the ratable value of the property in each parish. Each parish paid as before for the maintenance of its own roads. The Act of 1878 unites, wherever possible, highway and sanitary districts. It also enlarges the areas of road management in England in several important respects, and gives the county authority a control over the authorities of the highway areas, while leaving to the latter the duty of repairing the roads within their district. In order to secure the appointment of competent surveyors, any two or more highway boards may unite in appointing and paying the salary of a district surveyor, who shall in relation to the district of each of the boards

by whom he is appointed have all the powers and duties of a district surveyor under the Highway Acts. A classification of roads is also made by the act; all roads which since 1870 have ceased to be turnpike roads, and such other important roads as seem to the county authorities to be of county significance, are declared to be main roads, and one-half of the expense incurred by the highway authority in the maintenance of such a road is to be paid to the highway authority by the county authority out of the county rate, on the certificate of the surveyor of the county authority to the effect that such main road has been maintained to his satisfaction. The county authority may reduce the status of a main road half supported by the county to that of an ordinary highway supported entirely by the parish. The local roads are no longer supported independently by each parish, but "all expenses incurred by any highway board in maintaining and keeping in repair the highways of each parish within the district, and all other expenses legally incurred by such board, shall \* \* \* be deemed to have been incurred for the common use or benefit of the several parishes within their district, and shall be charged on the district fund." By the Act of 1888 "every road in a county, which is for the time being a main road, shall \* \* \* be *wholly* maintained and repaired by the council of the county in which the road is situate," so that now the full control and management of main roads is in the hands of the County Council, and the full burden of support, and the responsibility for failure to keep in order, rests on the county. The provisions made by the acts for the erection of highway districts did not at first meet with great popular favor, though the government has persevered in its policy. In 1882 it was reported, that out of some 14,000 parishes about 8,000 had been created into districts, the number of districts being about 400.

The *State* assumed much of the expense of the road making in matter of fact, though this does not appear in the law. Since 1883 one-half the expenses of the county authority has been refunded by a parliamentary grant out of the exchequer; and since 1887 one-half of the expenses of both the county authority and the highway authority have been refunded in the same way.

To sum up then the changes which have been made in Eng-

land, we find that the territory of the administrative unit has been enlarged, the roads have been classified, and skilled men have been entrusted with the execution of the work upon them. At present, it seems that the ordinary roads of a county are under the care of district boards instead of parish or town authority, and that the main roads are under the care of county boards, by whom they are wholly maintained and repaired. It seems to me that the tendency to centralization will continue until the district becomes co-extensive with the county, and the management of all the roads in the county are placed under one board.

Management by county areas has been general in Ireland since 1836, and with the best results as to the excellence and economy of road maintenance. In Scotland, the roads of many of the counties have been under one management for years, and by the act of 1878 the system of county management is extended to all parts of the country.

Canada, also, gives its counties the right to assume the full management of the important roads of the country.

We have now examined briefly the methods by which the roads are managed in the older countries, where the best constructed roads, and those maintained in the best condition, are found. The density of population and accumulated wealth in those countries is greater than in Vermont, and in other respects our circumstances are such that it is doubtless impracticable to adopt without modification any of the methods of administration described. Still their experience is not without its lesson for us.

We need to put our roads under the supervision of trained and experienced men who have made a study of the questions involved.

We should have our roads classified with reference to their relative importance. Two classes may be sufficient, the first class comprising main roads, or those connecting larger towns, in the same or adjoining counties, and in general the stage lines and roads connecting several towns; the second class comprising roads connecting those of the first class, and the merely local roads.

The extent of the administrative unit should be enlarged. It seem to me that the county unit is none too large for economy of administration. The permanent employment of skilled officials,

and the purchase of the machines and tools necessary for properly macadamizing and repairing roads would consume too large a portion of the road fund of a single town. Moreover, an engineer or roadmaster could easily supervise the roads of several towns, and most towns would have occasion to use the expensive machinery such as steam roller and stone crusher only a small part of the year, and the capital invested in them would, therefore, remain idle the larger part of the time.

Let the roads of the second class remain, if desired, in the charge of the town officials to be supported and managed by the towns. But roads of the first class should be put in charge of a county board, in which each town should have at least one representative. In order to give a quality of permanency to this board, the term of office of not more than one-third of its members should expire in one year. They should classify the roads of the county and have entire charge of the reconstruction, repairs and management of those of the first class, determining the amount to be expended on them and where it should be expended. They should have power to lay a tax, within prescribed limits, on the county. A definite portion of this tax, at least a quarter of it, should be used for the gradual reconstruction or permanent improvement of these roads.

They should have authority, under proper restrictions, to borrow money for the more rapid reconstruction of these roads.

They should appoint a civil engineer, who should have general supervision of the work done on the roads, and all construction and repair should be done in accordance with his directions. At the beginning of such a system he should advise the board as to the proper classification of the roads and submit a general plan for their improvement and reconstruction, with an estimate of cost. He should suggest such change in the classification of the roads as may seem desirable from time to time, and should give advice in regard to the repair of roads of the second class when requested by the town authorities. He should divide the roads of the first class into sections or districts of proper extent, and appoint a roadmaster for each section, who should work the roads under the direction of the engineer, to whom he should report, and by whom his

work should be approved. The roadmaster and such number of permanent laborers as the extent of his section may require should be continually at work on the roads, and temporary workmen should be employed as occasion may demand. The engineer should submit to the county board an annual report in detail containing : 1st, an account of the work done on the roads for the past year, describing the kind of work performed on each portion of the roads under his supervision, giving the cost of material and of labor, and setting forth their general condition, and the results of previous improvements ; 2d, a detailed plan of work which seems advisable for the coming year with careful estimate of cost. He should be retained in office so long as he is competent and attentive to his duties, and should not be subject to removal for personal or political reasons.

The reconstruction of roads, and repairs so far as possible, should be done by contract work. The work to be done should be plainly set forth by the engineer ; such plans and specifications as may be needed should be prepared by him, and the completed work should be subject to his approval. The contracts should be given to the lowest responsible bidder, and neither the engineer nor any member of the board should be in any way pecuniarily interested in the contract. The ordinary repairs could probably be done most satisfactorily by day's work.

To reconstruct our roads in the manner proposed would necessarily increase the total road tax, but the cost of maintenance after reconstruction would be but a moderate charge. I believe the increased value of farming lands, the decreased cost of transportation, and the benefits to the citizens in both town and country from the increased facilities of intercommunication, would be cheaply purchased by the reconstruction of our main roads.

Mr. Satterthwate of Montgomery Co., Penn., in an address to the Board of Agriculture at Bloomsbury, said : " We find it pays to macadamize roads, and our people would not like to be restricted to a tax of seven mills, because sometimes we want to spend more than that. We have learned that it pays to make good roads, no matter what it costs. Everybody says if you will make the roads *good* we do not care for the tax. It is when you have



nothing to show for money expended that they complain. Any enterprise which reduces the cost of transportation of crops and merchandise 40 per cent adds to the annual income an unknown large per cent and increases the value of land 25 to 50 per cent, should commend itself to the self-interest of every farmer in the State."

I believe the present tax is one and one-half mills in this State, which is all that is raised ordinarily. Under the proposed arrangement there would be both a town and a county road tax. The town tax could probably be reduced to one mill. But the county tax would increase the total road tax by a sum depending upon the rapidity with which the work of reconstruction of the main roads should be carried on. In many of the States there is no limit to the road tax fixed by law. In Pennsylvania, Minnesota and Colorado the road tax is not to exceed ten mills, in Wisconsin it may not exceed seven mills, in Ohio, Nebraska and Iowa it may not exceed five mills. To undertake the work proposed would probably require for a number of years a tax of from three to five mills, unless money was borrowed.

In the newer States and in those increasing rapidly in population, it may be advisable to borrow money for such purposes. But with us it seems to me better generally to avoid such a course and reconstruct more slowly. Already some of the States are seeking to improve their road laws in a manner similar to the one just outlined. A bill was introduced into the Legislature of Pennsylvania last year providing for a uniform road tax of seven and one half mills to be raised in each county by a board of road commissioners, and expended under their direction by a county engineer, provided that not less than 40 per cent of the road tax shall be expended in macadamizing or other permanent improvement. The act further provides that the county engineer shall be appointed by the Court of Common Pleas, that roads shall be classified into highways, roads and lanes, and that the county shall be subdivided into districts, each in charge of a supervisor. The New Jersey Legislature passed a similar act last year, which would be, in many respects, a model for this State.

# ADDRESSES BY MEMBERS OF THE BOARD OF AGRICULTURE.

---

## GROWING AND HARVESTING OUR FODDER CROPS.

---

BY ROLLIN C. SMITH OF PITTSFORD.

*Member of the Board of Agriculture.*

Vermont's leading industry is the dairy and the successful dairyman makes feed for his cows as much of a study as the present house wife does of the wants of the family. Nearly every farmer buys grain to a greater or less extent and the amount of money sent out of the state for this kind of fodder is enormous, and every Vermont farmer should strive to raise his own fodder and harvest it in such a manner as to obtain the greatest results. Grass is the natural production of our state, and probably about nine-tenths of our cleared land produces it. It is not only the most natural feed but the cheapest and produces the best results, whether you are feeding for milk or growth, and when we come to feed after the pasture fails we should try and imitate this feed as closely as possible.

Hay should be simply grass in a dried form, but very little of it is found in such shape in the barns of the average farmer. The experience of Amasa Scott, though perhaps not practicable, should serve as an object lesson to every dairyman in the country, he having made the best records in producing both beef and butter by simply feeding very early cut hay and pasture grass, mowing his meadows three and four times in a year. Farmers who are making a specialty of producing milk in winter are waking up to this fact and there is much more hay put into the barns in June than there was ten years ago. But not only are dairy farmers benefited

by early hay, stock raisers are equally interested, as any feed that produces a large amount of milk produces a like ratio of growth in a young animal. Aside from cutting hay early in the season I am inclined to believe that the time in the day and conditions of the weather have something to do with the feeding value of the hay. As I am not a chemist I do not speak advisedly on this subject but only from observation. For example: Every farmer who weighs milk will notice a shrink in his milk after a very heavy rain, even when his cows have not been exposed to the inclemency. The cows come up looking full but fail to respond to the usual amount. The theory is that the gummy substance on the outside of the grass which is highly nutritious has been washed off by the rain and what the cow has eaten is lacking in nutriment. Now if this is a fact, has not our hay which is mown directly after a heavy rain been robbed of more or less of its nutriment? Every person who mows grass will notice that no gum is found on the scythe at such times, when if mown in the afternoon after a day or two of warm sunshine the scythe will be coated with that gummy substance, and when cut late in the afternoon it is fit to draw much earlier the next day than if allowed to stand till the next morning.

Again, the importance of having only good hay is too often overlooked by farmers. Hay should be the fodder of most importance and the difference in value between hay seasonably harvested and that cut late and put in in poor condition is much more than we generally suppose. Hay that will simply sustain life is of very little value, and it is a waste of time to feed stock any kind of feed that produces neither growth, milk nor fat. It is very doubtful if grain can be bought and fed to stock and get the money back unless the foundation or basis of the coarse feed is of the first class.

Next in importance as a feed comes the corn crop, and too much cannot be said in its favor, because of the very large amount which can be grown on an acre, the ease with which it can be grown and the very fine condition in which it leaves the land after the crop has been taken off. The grain is always in order on any farm, and the stover is valuable also, and if this State should

raise five times the amount we should send very much less money out of the State, thereby increasing the wealth of the State.

The most economical way to raise corn is to prepare a piece of green sward as follows: After the hay is taken off, begin as soon as practicable to put on the manure. Always spread broadcast and the sooner the manure is put on the better, for it starts and produces a larger growth of grass, the value of which we will mention later. Of course it is not expected every farm will have manure enough on hand in August or September to cover a very large area, but put it on as fast as made; would, if practicable, draw from the stables every day during the winter, thinking more manure is wasted before it leaves the barn yard than after it reaches the field. Would prefer to have the manure all spread before the first of March—spread on the snow is not objectionable, and unless your side hill is so steep the soil will wash off, very little of your fertilizer will be lost by washing. Now the theory is this: Plants take their nourishment from the fertilizers only after they have been reduced by moisture, and this manure which has been exposed to the fall and spring rains has had the fertilizing elements washed into the soil where it can be utilized by the growing crop.

If there is a right and wrong time to do work, there is certainly no exception with plowing. Unless it be a heavy clay, which cannot be stirred in the spring and must be plowed in the fall, plow in the spring—the best results I have are from spring plowing—and do not plow a field till you are ready to put a crop in. I do not believe our New England soil is very much improved by being exposed to our rigid winters without any covering. Sandy land especially is made poorer by being exposed during the fall and winter. Nature seems to cover all the soil with some kind of vegetation when it has a chance to do so. Have the manure applied early enough so that every weed seed will germinate before time to plow.

The objection to plowing in the fall and applying manure in the winter is:

- 1st. It costs more to fit the land properly for the crop.
- 2nd. The foul seed which you always have in farm yard

manure will grow and thrive in spite of all the harrowing you can give it.

3rd. Unless your manure is free from all strawy substances you cannot work your ground with modern machinery to good advantage.

4th. You lose the growth of grass that grows very fast where the manure is put on before plowing.

This I think is an item of some consequence, and I notice the largest growth of corn on my farm is where the manure is put on in August and not turned under till ready to plant. Then the grass at about the 15th of May will be nearly or quite six inches high, and every seed in the manure has germinated and started to grow; the plow turns this all under and you plant your corn and it has an equal chance with the weeds that follow the plowing. This growth of grass and weeds you turn under is a quick and active fertilizer and no farmer need buy commercial manures to raise corn on natural corn ground when treated in this manner. One objection to this method is the cost of plowing. It requires much more strength of team to plow at this time than just after the frost leaves the ground.

The cost of attending the crop depends largely upon how the ground is prepared before the corn is planted. If you have ploughed so early and shallow that you can see the grass springing up between the furrows the labor to keep the land clean from weeds will be much more than if it is all clean. "Hoe your corn before planting," says one of our oldest farmers in the State. Harrow, pulverize, make it mellow, do all the work you can before the seed goes into the ground, and every hour you spend in this way means half-days in some instances when your crop needs attention. Do not plant with a hoe. Use some kind of a machine. A horse planter is preferable. No man with a hoe can do as uniform work as a horse planter will. Kill your weeds before the corn comes up. As soon as your corn is up, or even before, go over the field with either a Thomas harrow or Breed's weeder, and keep going over it. One man and team will do more efficient work in one-half day than twenty men would with the hoe. Use these implements as long as you can without impairing the crop.

One word of caution about drawing a harrow over corn. Never do it when there is any dew or rain on the plant. Corn perfectly dry and in a hot sun is quite a rugged plant, but corn wet with dew or rain is very brittle; better harrow on a hot day in the afternoon. After cultivation may depend upon circumstances, but after you are through with the harrow your field is perfectly smooth, no elevated hills, but smooth as a mowing field.

Shall we pile up earth around the corn? Our fathers raised good corn by running a small plow twice between each row and then pulling the earth still higher up with hoe, but I think I have seen better corn where the land was smooth enough for a mowing machine to run over either before or after the corn was taken off.

How shall we cultivate? Corn sends out its feeding roots near the top of the ground, and they extend from the hill about as far as the stalk grows perpendicularly. Now is it not necessary to go deep with this cultivation? If the surface is just broken you do not injure the roots, but if you run deep you are root-pruning the plants which is an injury. Every agricultural journal for the past quarter of a century has advocated level culture for corn, yet every implement we buy is made for hilling.

A cultivator on the same principle as a smoothing harrow to run between the rows, will do much more satisfactory work, provided your land has been properly fitted for it. It needs no earth thrown towards the hill, but the surface of the land needs stirring lightly.

In the White river valley in this State, the farmers have practiced for some time level cultivation and sending to grass after the last cultivation with good results—both as regards the crop of corn and the catch of grass—the land being left in a much better condition after the corn than if followed by a crop of sowed grain. I have practiced this with satisfactory results during the past two seasons.

How shall we harvest the crop? The silo has undoubtedly come to stay in New England, and if the corn has been raised for cattle of any description the silo is the place for it. Labor is the

problem for the Vermont farmer to solve. If he puts his corn in the crib, husking at 4c. per bushel for ears, will make about 10c. for each bushel of shelled corn; then the shelling, taking to mill and grinding, counting labor and toll, you have paid a very heavy tax on that bushel of corn before it is ready for use. Your stover, if husbanded in good condition is valuable, but the average farmer seldom gets it so. Now if put into the silo you have all the feeding elements there. You have it in a condition in which it is relished by the animals and where there is the least possible waste. No husking, no grinding, no milling, no extra expense except hauling the green fodder. Corn for the silo should be raised just as it should be for the crib. The more perfect plant you put into the silo the better silage you take out. It is a great mistake to put on too much seed when planting for the silo. The early silos in the State which were thrown aside were where they were filled with thickly sowed corn, in some instances as high as four bushels of seed to the acre. One spear of corn to the square foot matures the plant in its most perfect condition, and if more than this amount of seed is sown the nutritive part of the crop diminishes.

Corn may be put into the silo either whole or cut. It comes out of the silo best when cut, but the ensilage is no better, and more can be gotten into the same space when put in whole. It should be put in by course and taken out the same way.

Ensilage is a valuable feed for various reasons:

- 1st. For the nutritive elements it contains.
- 2nd. It is a succulent feed.
- 3rd. All cattle relish it more than any other fodder grown on the farm, and by actual experiment it has been found that anything the animal devours greedily produces better results than the same amount of feeding value fed in a shape that the animal does not like.
- 4th. It is easily masticated and digested, and this element in a dairy feed is of great importance. No feed produces good results in the dairy which is not easily masticated and digested.

Oat hay is also a cheap fodder, and if a bushel of peas are sown to the acre it will make it still better. It needs to be cut as soon as heads of grain appear.

## INTENSIVE FARMING.

---

BY J. O. SANFORD OF STAMFORD.

*Member of the Board of Agriculture.*

Statistics show that our average yield of hay is but a trifle above one ton per acre. Now taking into account the fact that some farmers obtain more than twice this average yield from their farms, brings us to consider the exceeding low yield from a large class of New England farms. And it raises the question: How can these farms be brought up to a better state of productiveness? And we are led to consider some of the causes that have reduced these lands to their present condition.

Is the soil exhausted, as some say? Only in fertility. We prefer to take that view of the soil that treats it as the mechanical agency by which the elements of fertility are converted into products fit for the farmer's use. These lands were first ploughed by the mighty glacier, grinding, pulverising and mixing the rock and organic matter, forming a soil that is imperishable, and well fitted to do good work with what it has to do with, as long as animal life endures.

This variously composed disintegrated rock containing much plant food, gives our soil a peculiar fitness for perpetual work, and the endless process of disintegration gives to our soil certain fertilizing properties that give to New England and her Green Mountain ranges that peculiar rich verdure that is so much admired.

We hear it said that western competition has caused these conditions, but we find in the very midst of these run down farms large towns and manufacturing villages, whose inhabitants are calling for the products of New England farms at generous prices—but are obliged to go elsewhere for their supply. If we consult the western agricultural literature of the day, we shall learn that they are exercised over the rapid decline in the productiveness of their land. They are trying to solve this same problem of how to restore and maintain the fertility of the farm. We shall learn



of their regrets for their wasteful practices like the selling of grain and burning the straw that has been so much practiced in some of those states, and that has reduced their yield of wheat from thirty bushels per acre to ten and less.

In considering the causes that have brought about this low state of productiveness, we must take a retrospective view and consider some of the changes that have occurred in our own country.

Consider the condition of things, when the wild beasts of the forest and the vast herds of the plains dominated the whole land, with none to molest or make afraid. That was a system of farming in which man had no part. But the ingredients and elements of fertility were being stored in the land for use in the coming time.

Later we find the red man of the forest with his rude implements subduing and conquering, instituting a higher order of things, and a better system of farming, even cultivating the soil to a small extent. That system of farming afforded the people a comfortable and satisfactory living. There was variety among the people and the different clans and interests made the choice of locations and favorable hunting grounds, questions often settled by wars most savage and brutal. All tending to develope and strengthen the peculiar traits in the character of that people, who were adapted to the situation and fulfilled their mission upon the earth.

In the fullness of time the white man began upon our eastern border with a new and much improved system of farming. Instead of roving over the land in pursuit of game on which to subsist, they parceled out with meets and bounds, the God-given land that each family might have and enjoy that which the red man had never known, a sacred spot, called home. This necessitated subduing the forests, a hard and laborious task, but these people were born and bred for the work, not skilled in the arts or sciences, but with brave and sturdy manhood—an inherited robust constitution that gave strength and courage for the emergency. A faith in God that was an inspiration and a strength sufficient to carry them through and above all hardships, trials and dangers they wrought and carved out of this mighty forest-land, their homes and farms, the towns, States, the nation. Little

did they know they were working out a higher order of civilization than the world then knew. The land gave up in fields of waving grain the fertility that had been stored for ages for the very purpose of building the grandest nation the world had known.

There grew up in their train, village and city with improvements in mechanical arts and scientific discoveries. That system of farming passed slowly but irresistibly across our country utilizing the fertility previously and providentially stored for building this republic, and it still lingers on the plains of the West. But what has it left behind? A higher civilization than it was possible for them to dream of, a land dotted thick with cities, interlaced through and through with railroads, telegraphs and every conceivable appliance to facilitate the business relations as well as the social intercourse of the millions of intelligent and cultured people.

Would we exchange the present with all the great advantages that surround us for the past? Shall we blindly complain of our ruined and worn out farms, forgetful of the fact that this great national wealth of which we boast is but the result of that system of farming that has transferred the latent and mysterious elements of fertility from the land into material and enduring wealth?

We follow with a new and improved system requiring less manual labor but more of the mental, demanding a knowledge that not only enables the farmer to manipulate the soil and the elements of fertility but teaches him how plants grow and on what they feed. We must recognize the fact that we are surrounded by entirely different conditions from our predecessors. They have left us the soil and the possible knowledge of applying forces that will produce crops far in excess of anything they knew.

In order to succeed in our conditions we must learn to feed the plant. Under the old system the farmer planted the seed and trusted providence for his crop. There was a mysterious something he called providence that was a great factor to his success, but we must learn to trust ourselves, not unmindful of our dependence upon the Great Father who gives us seed time and harvest, but

intelligently working in harmony with his providences and along the line where nature is waiting to assist us, our own best endeavors will lead us to success.

Those valuable elements, nitrogen, potash and phosphoric acid, that in variable proportions enter into all our crops and without which they cannot grow, are the farmer's capital, his stock in trade, and should never become exhausted.

Like his bank account, in order to draw money on his checks he must make deposits ; if he fails in this his checks are not honored; so with his soil, his demands must be limited to the amount on deposit there. Then how important that all the manurial value of our crops be returned to the soil. Our barns and stables should be so constructed as to save all the manure of our animals, both solids and liquids. It is comparatively a new theory that the liquids contain more fertilizing value than the solid excrement, and yet since it is considered to be true how few farmers take any special pains in saving it. The plant food wasted on farms is enormous. Consider some of the wasteful practices that have come down to us from the old system, the use of those barns and stables that were constructed merely to shelter the stock and the fodder, the feeding of stock in the open yards or fields, improper methods in the care and use of manure, feeding the meadows fall and spring. The wasteful practices that allow so much of our fertilizing elements to go to waste are costing the farmers of our State hundreds of thousands of dollars annually. It is undoubtedly true, that many farmers are paying hard earned money each year, for potash, nitrogen, and phosphoric acid, and at the same time are allowing more of these elements to go to waste on their own farms than they buy. The manures made upon our farms should be considered as a farm product. In fact it is, it represents a portion of our farm crops and purchased foods, and that portion that is indispensable for us, for if we loose it we must buy more for we cannot proceed without it. This should be kept constantly in mind by every feeder, and when we adopt this idea and habitually consider and conduct our business accordingly we shall meet with much better success.

The system of farming that preceded us has been called "ex-

tensive farming," and is that system that is adapted to all new countries where fertile land is cheap and plenty. It requires large areas; the more land a farmer had the greater his income. This gave the farmer a grasping desire for more land, and the prominent idea on which he worked was to gather in, gather wealth from the land, and that without replenishing or returning an equivalent.

New England has not had due credit for the wealth that has been taken from her farms. If this wealth had been invested in replenishing fertility, or in general farm improvements, or in developing her natural resources, instead of being used for building up other states and farming sections to compete with in her own markets, what would she have been to-day?

A remedy for the unsatisfactory conditions that confront us will not be found in legislative enactments, nor in political reforms, but in a radical change in our system of farming. We are in a transition state passing from the system of "extensive" to that of "intensive farming." This change is a forced necessity, and incurs much inconvenience. Much of the land that was serviceable in the old is of little value in the new. This new system calls for concentration, and for a more thorough and better cultivation and better crops from our best lands. Intensive farming means, not so much in intense activity and excessive labor on the part of the farmer, as an earnest and intelligent comprehension of his whole business. He will consider his farm not as a temporary stopping place, but as a permanent home, where the highest joys on earth are centered and where he expects to end his days, leaving it with the glad expectation that it will be kept as a family inheritance. He will consider his occupation as not inferior or beneath that of any other legitimate business. He will claim for himself the same social, business and political standing that is accorded to other men.

In reality he is a manufacturer, using his farm as the factory by which he converts the raw materials into products of the finest excellence and his farm will be kept in the best possible condition for doing its work.

We can readily tell the fate of the manufacturer who failed to adopt and practice the modern and intensive system of manufac-

turing. What would be the impression should we find a factory using the motive power, machinery and methods of forty years ago. The general appearance of such a plant would be a bar to the sale of its products, or the favor of credits.

Instead of working on the main idea of gathering in and selling his products which are both food and fertility, he will conserve the fertility of the farm. In deciding the propriety of selling hay for ten dollars per ton at the barn, he will reckon the six dollars and fifty cents worth of fertility contained in that ton of hay as belonging to his land from whence it came. And as he prefers not to sell his farm in this way, by piecemeal, he will calculate whether he can afford to sell hay for the remaining three dollars and fifty cents per ton.

The advantages of intensive farming over the old methods are obvious. There is less land to work, better crops and better profits. An example. The farmer decides to raise one hundred tons of corn for the winter feed for his stock. The size of the field to produce that amount of corn must be determined. Under the old system ten or twelve acres would be required, while under the new six acres is sufficient. When we calculate the difference in the expense of producing the same amount of crop from six acres or from ten or twelve acres we shall be able to determine which gives the greater profit.

Compare the profit of producing hay, three tons per acre, or one ton per acre.

The value of the product of the three—ton acre is .....	\$30.00
Less the manual value of three tons hay .....@ \$5.00, \$15.00	
Less cost to harvest three tons.....	\$3.00    18.00
Net profit.....	\$12.00
The value of product of the one—ton acre .....	\$10.00
Less manual value.....	\$5.00
Less cost to harvest.....	1.00    6.00
Net profit.. .....	4.00

The first giving a profit of twelve dollars or paying the interest on a valuation of two hundred dollars per acre and the last a profit of four dollars or the interest on a valuation of sixty-six dollars per acre.

Let us compute the results of raising corn under similar conditions.

One acre in good condition.

Hauling and spreading manure.....		\$ 3.00
Plowing, harrowing and seeding.....		4.00
Cultivating.....		3.00
Cutting.....		2.00
Hauling 18 tons corn.....		3.00
Cutting into silo 18 tons.....		3.00
Cost of labor.....		<u>\$18.00</u>
Value of 18 tons corn \$3.33.....		\$59.94
Less cost of labor.....	\$18.00	
Less manual value of 18 tons corn \$1.50.....	27.00	45.00
		<u>\$14.94</u>

One acre in poor condition.

Hauling and spreading manure.....		\$ 3.00
Plowing, harrowing and seeding.....		4.00
Cultivating.....		3.00
Cutting.....		2.00
Hauling 10 tons.....		1.50
Cutting into silo 10 tons.....		1.50
Cost of labor.....		<u>\$15.00</u>
Value of ten tons corn \$3.33.....		\$33.30
Less cost of labor.....	\$15.00	
Less manual value of crop.....	15.00	30.00
		<u>\$ 3.30</u>

One acre giving a profit of \$14.94 which is equal to the interest on a valuation of \$250.00 per acre. While the \$3.30 profit of the other acre is the interest of \$55.00 per acre.

Another example. A dairy farmer, with a herd of twenty-four cows. Under old methods he made butter through the summer, selling it for a very low price, in winter his cows were dry, consuming two and one half tons of hay each, aggregating sixty tons, and requiring sixty to eighty acres of meadow land for its production. With modern methods sixteen acres of meadow land well farmed will produce their winter fodder.

Ten acres of hay, three tons per acre, 30 tons.

Six acres of corn, 18 tons per acre, 108 tons.

Daily winter ration per cow, hay 12 pounds, corn 30 pounds, cotton seed meal 2 pounds, wheat bran 3 pounds. This will require thirty tons of hay and eighty tons of corn and five tons of cotton seed meal cost.....@ \$27.00				\$135.00
Seven and one-half tons bran cost.....@ \$22.00				\$165.00
Making the cost of the purchased feeds.....				\$300.00
This herd should make through the winter eighteen pounds of butter per day, and for 210 days or seven months 3,780 lbs. at 25 cents.....				\$945.00
Less cost of grain bought.....				800.00
Leaving.....				\$645.00

As the *feeding* value of the products of sixteen acres, an average of \$40.31 per acre. Now if this shows, that farming on land in a good state of fertility is remunerative, it also shows that the farmer who is content in taking meager crops from run down land is working his own farm on shares, and getting but a small share at that. The idea of taking crops from the land as long as it will give them that will pay for the taking is erroneous. Two crops a year from the same field should be the rule, but the land should be always in a high state of fertility and when it is once brought to a high state in productiveness it should be kept constantly at work and never become deficient in plant food.

As to general farm management on a run down farm with the purpose to bring it up to a better condition, we would suggest the following method, beginning April 1. A twenty-cow dairy farm, buildings in fair condition with slight alterations and some inexpensive repairs, we are ready to proceed. Our pasture is large and thin, furnishing passable feed in the early summer. The meadow lands are well nigh exhausted. A small portion near and just below the barn is giving fairly good hay but the greater portion is yielding nothing but white top or native grass, not much more than half a ton per acre. We said it was a twenty-cow farm, but in it's present condition will scarcely carry half that number. The first thing to be considered is the corn crop. For this field we will select that portion of the meadow land most feasible, and bordering on the highway. First we will remove the fence between this field and the road. We judge this field has been used for pasture as well as meadow, and that treatment has done much

to bring it to its present condition. With a reversible plow we begin at the road and plow on the side of the field. We want long rows and will go the whole length and plow five acres. If we have plowed it well and the furrows are evenly laid, we may omit the harrowing, otherwise the field should be thoroughly harrowed before applying the manure. But the most essential thing is to get it well manured. We will scrape these premises thoroughly; the barns, the yards, under the barns, every nook and corner; if there is no cellar under the stables we will take up the floors and take out the fertility that has been accumulating there for many years. We will scrape the floor of the poultry house, will take the hen manure saved during the previous winter, mixing it with earth or muck and plaster, composting it thoroughly. We will have a general "cleaning up time." There is a festering pool near the house where the house slops have accumulated from the sink spout; we will clean this out, digging deep to get all the fertilizer, and to rid our family of the danger of this poisonous mass, waiting to do its work of death. We will apply it all to this corn field, and if we have not succeeded in getting over the whole field, we will get some more somewhere else. When we are ready to plant we will plant by machine and will use from 150 to 200 pounds of concentrated fertilizer per acre. The kind of fertilizer has been determined by our study of the subject the previous winter, and by the aid of the Experiment Station work and other agricultural literature we should be able to judge fairly well. When the corn is planted we continue the plowing till we have three acres more. This is thoroughly pulverized and sown with oats and peas with a dressing of some fertilizing material our best judgment has dictated us in buying. We will enlarge our plowed ground by taking on two acres more. This last two acres should be sown at the proper time with buckwheat with a light dressing of suitable fertilizer. Now while our crops are making their growth with our constant care and attention we are anticipating the next year.

The cows are stabled nights, the manure of the horses, hogs and hens, the slops from the sink, the ashes made, and all we can buy of those who would throw them away, these are all carefully



looked after. There is no preventable waste. Harvest time comes. The hay comes first. We will cut it early. This native grass is poor enough at the best, and is very poor when it gets ripe. Cut the oats and peas as soon as the oats are headed out; hay them carefully and store in the barn. Later comes the corn. Harvest it just as the ears are beginning to glaze and store it in the silo. The buckwheat we shall have to thresh, using the flail. While one man with a team is hauling it to the barn, another setting the stacks in an upright position upon the floor threshes them down. The straw is stored in the barn for fodder. When the pasture begins to fail the cows are fed hay, or oats and peas, till the corn is in the milk, then they have corn once a day. About September 1st they are started on a small grain ration, and from October 1st they are kept in the barn and fed full rations of grain and fodder.

Now the harvest is past and the summer is ended, and we have saved our crops, but our work is not done. The fields must be plowed and the manure must be hauled and spread on the field that gave us the corn. Scrape things thoroughly and get enough to spread all over it. Winter comes. The stables are all made warm and comfortable, provision is made for saving all the manure. We give personal attention to the care and feeding of the stock, and we soon find we have come again to April 1st, and here we stop to see what we are doing. We find we harvested of the corn sixty tons, of hay twenty tons, oats and peas five tons, of buckwheat straw two tons, buckwheat forty bushels. Our stock consists of two horses, ten cows, four yearling heifers, and a few heifer calves, with feed sufficient to carry them through the winter, two of the cows will soon drop their calves, having been dry about eight weeks. The other eight cows came in milk from August to November and have done good work through the winter. Here is their account, we will call the feeding season seven months and will reckon it for that period:

Daily ration for each cow:

Hay 12 lbs., corn 30 lbs., bran 3 lbs., cottons. m. 2 lbs., buckwheat meal 1 lb.,  
 Cost .06 cts. " .05 cts. " .08 $\frac{1}{4}$  cts. " " .02 $\frac{1}{4}$  cts. " " .01 $\frac{1}{4}$  cts.  
 daily ration 18 $\frac{1}{4}$  cts.

For 210 days, hay 2520 lbs., corn 6300 lbs., bran 650 lbs., cotton seed meal 420 lbs. buckwheat meal 210 lbs. for each cow.

Cost, hay \$12.60, corn \$10.50, bran \$6.93, cotton seed meal \$5.25, buckwheat meal \$3.15, per cow \$38.43, and for the eight cows \$307.60.

The eight cows have averaged one pound of butter each per day, making in the 210 days 1680 pounds which sold for 25 cents per pound amounting to \$420.00. So I find they have paid me for hay \$100.80, for corn \$84.00, for buckwheat \$25.20. They have also returned to me the \$97.44 I paid for the bran and cotton seed meal and have given me a profit on the transaction of \$112.76 besides leaving me all the manure made from my own fodder and in addition to that the manure made from the cotton seed meal and bran which is worth at least fifty dollars more. We are so well pleased with the results we have resolved to do more in this line next winter and will begin preparations now.

The field where we had corn shall be sown early with oats and peas, seeding at the same time with clover, timothy and red top. The five acres where we had oats and peas and buckwheat shall be put to corn, and will be well manured, the manure being better and more of it this year we must try to increase the yield of corn to eighteen tons per acre. Five acres of the old sod have been broken up right along beside that already under cultivation. If there are swales they must be ditched, if any obstructions remove them, if trees they should be rooted out, we cannot afford to work around them. This last field is sown to oats and peas. Harvest time comes again and we find we have increased our store of fodder and must increase our herd, we have more corn, ten acres of peas and oats, five acres of rowen. We shall continue on this same line each year till the field we first seeded fails to give two good crops per year, then we shall return going over the same land in the same order, first with corn seeding with clover and grass sown the time of last cultivating and never taking up more of the old meadow than can be handled in this way.

This method of farming not only develops the farm but the farmer as well, giving him a broader and better conception of his business and a consciousness that he is accomplishing something. Strangers passing that way will read his character in the outlines of his farm, and that close relationship between him and good old mother earth will bring him nearer to his God.

## THE CARE AND APPLICATION OF MANURE.

---

By J. O. SANFORD, OF STAMFORD.

*Member of the Board of Agriculture.*

The success of the average New England farmer of to-day depends largely upon his appreciation and understanding of this subject. The true value, office and importance of manure in growing crops has been but recently understood. The farmers of the past, whose farms were wrought out of the primeval forest, were favored with a fresh and fertile soil. Well do I remember when portions of the forest on the farm where I now live were felled in large winrows and when in proper condition the fire-brand applied and they were reduced to ashes. When these lands were cleared, seeded and stocked with cattle or sheep, how the farmer's soul delighted in fatness, and his great ambition was to acquire more land. Selling year after year the products of the soil, drawing continually upon fertility without replenishing, till after a generation we find these farms contracting, diminishing, degenerating, and we hear a wail of sorrow for our "deserted farms," a poor term indeed to be used in this connection, for it has given a wrong impression in regard to our agriculture. Much of our rough land has become so deplete in plant food it is well to abandon it and confine our operations and efforts to fewer and better acres. These places we call "deserted farms" are no more worthy to be called farms to-day than are the places where our fathers got their grain ground by the old flutter wheel to be called mill privileges. When I look for the causes of my success as a farmer of these times, I attribute one of the causes to the fact that I have abandoned a portion of my land, and more than doubled the production of the whole by so doing. I think the late and lamented F. D. Douglas was quite right when in an address at Burlington in 1889, he said: "I emphatically deny that there are deserted *farms* in Vermont. There is much abandoned *land* and ought to be more."

Vermont land is yet valuable for farming purposes. All things considered there is no better place to farm than Vermont to-day. Now we have great and superior advantages. The enviable reputation our State has acquired for superior dairy products, noble horses, the best of sheep, fine maple sugar, intelligent men and fair women, this alone should fill every Vermonter's soul with pride, and it is of intrinsic value to us as farmers, evidenced by the fact that the products of other localities and States are put upon the market falsely branded "*Vermont*."

We are in close proximity to the great and growing markets that are ever ready to encourage the production of an article of superior excellence, which our soil and climate are sure to produce by the skill and earnest endeavor of the intelligent husbandman. While Vermont occupies but a small and insignificant spot upon the map of our country, yet when she speaks in the Senate of our nation her words are well considered ; and when the nations of the earth brought together the works of their skill and the products of the farm, it was conceded and acknowledged that the best butter came from Vermont. How shall we maintain this exalted position unless we keep pace in these times of advancement and adopt improved methods in our business. The methods and practices of the past will not do for us. For generations the only system of growing crops was by tilling the soil, and it was finally discovered that applying the droppings of animals to growing plants had the same effect as tillage, and from that time it was taught that manure was a great help to growing crops, but not till a recent period has it been considered as wholly indispensable. No farmer of the present time attempts to produce crops without providing the proper plant food as well as thorough tillage.

Where and how to obtain this plant food is a vital question with each and every one of us. Can it be produced upon our farms in quantities sufficient for our use ? We are well aware that each ton of hay we harvest from our land contains six dollars and fifty cents worth of elements of fertility ; and it is also apparent that if we do not return these elements or their equivalent, we are robbing the soil. No man who owns and rents out a farm will allow the hay or other forage crops that are grown thereon to be sold

and carried away. It is a principle in law that the manurial value of these crops belongs to the real estate, and must not be removed unless an equivalent is returned. But how is it when these crops are fed out on our farms? What becomes of these valuable elements of plant food?

Thousands of farmers are to-day practicing the same old methods of their predecessors, using the same old barns built in an age when crops grew simply by tillage, and manure was considered only of secondary importance. Not a suggestion in their construction that would intimate that manure was anything more than waste material and scarcely worth saving. The liquid, the most valuable of the whole, passes through the loose floor into the ground beneath the barn and is entirely lost, while the solids are thrown out through holes in the side of the barn, to lie in heaps, usually under the eaves suffering a loss of nearly, or quite, one-half their value. Feeding stock in the fields or open yards, loses a large amount of the manurial value of the feed. It seems that if those farmers could realize that for each ton of hay they fed, there is a manurial value of \$6.50, and for each ton of corn stover \$5.25, for each ton of green corn fodder \$2.75, and for each ton of rowen \$8.00, they would feed with scrupulous care, with the purpose of saving all these valuable elements of plant food, to be used in growing their future crops. But still the waste goes on, and we find them the next spring buying the same elements, nitrogen, phosphoric acid, and potash, with which to grow more crops to be treated the same way. Such practices continued will surely end in bankruptcy. When we awake to a realizing sense of the enormous waste of the fertility of our farms, I believe a remedy will be found. It is gratifying to find in every town a class of farmers who are prosperous, thrifty, and uncomplaining, and it is encouraging to find this class constantly increasing, and if we search out their methods, we shall find they have comprehended the light, and are practicing those improved methods that recognize the importance of scrupulously saving and judiciously using all the fertilizing material of the farm, and recognizing the fact that manure is not only real estate, but the very essence of real estate.

As to the methods of saving and applying manure, I believe the farmer who is thoroughly awake and in earnest upon this subject will find the method best suited to his case. In the construction of barns, the question of ease and convenience in doing the barn work, and the care and preservation of the manure should be of prime importance. I believe this can best be conserved by a barn cellar beneath the stable, the bottom of which should be cemented, and the foundation walls laid in mortar tempered with cement. The expense is trifling compared with the advantages. We have learned that the liquid manure is of greater value than the solids, and there is no way more economical and convenient than to drop the whole into the cellar beneath. The objections often urged against this system of building are the foul gasses arising from cellar to stable and from stable to hay loft. They may be entirely overcome by proper construction. Having used such a barn for years, I do not find these difficulties. The manure is kept in the best possible condition, practically without waste, and ready to be drawn out and spread upon the fields at any time. Various devices have been tried for handling the liquids. We have found no better way than for the man who does the work to wear rubber hip boots and get right into it, using a fork, mixing the solids of the heaps with the liquids, which are absorbed, and the whole taken out together and spread upon the field.

If we must continue to use an ill constructed barn, then we may do much to prevent waste by tight floors and the free use of absorbents, and I know of no better material to be used in the trench than horse manure. It will hold large quantities of liquid and the whole will be much improved, and by the use of a wheel barrow and a few planks for a run way the manure can be wheeled into the yard and put into a compact pile, not covering too much surface. If we have used plenty of dry absorbing material we can build the sides up straight, always leaving the top flat or level, spreading the accumulations on top. By keeping the pile flat on top it will catch the rain, and hold moisture enough to prevent waste of ammonia when it heats. Plaster can be very profitably

used in all our stables, not only as an absorbent, but its mechanical effect upon the manure is very beneficial, and besides, it is an excellent deodorizer. Real large town farmers should avail themselves of the waste products of the factories. Wool waste from the woollen mills, when dry, is one of the best absorbents I have ever used, and being rich in nitrogen makes a valuable fertilizer. Tobacco stems from the cigar factory are a valuable fertilizer of themselves, and it will pay any farmer to haul them a long distance for the nitrogen and potash they contain. They make excellent litter for the stable, and as bedding for young cattle will prevent vermin. A great saving of manure is effected by keeping the cows constantly in the barn in winter, and nights during the summer. Some object to this by saying it robs the pastures but I have observed that those who practice it most are its strongest advocates. I believe there are many farmers who have a small mine of wealth under their stables which could be utilized by excavating to a considerable depth, and applying it to the fields, refilling this excavation with dry earth or muck, to be repeated yearly. Much has been said in favor of the process of composting and fermenting manure preparatory to its use upon the field, and there are many advantages in so doing. The bulk is very much reduced, and the coarser parts being broken down, it is more immediately available, but the process must be carefully done to prevent loss of the most valuable parts, and considering the extra labor involved, it is doubtful if it pays for the common farmer, but for the market gardener, who wants a quick and active manure, it may. The old way of putting the manure in small heaps over the field to remain a considerable time before being spread should be condemned, not so much for the waste of manure, but for the unworkmanlike manner, while there may not be any great loss in manurial substance, the soluble portions, which are the most valuable, will be worked down into the soil under the heaps, giving an excess to those spots, while other portions in the field are left without any.

It is doubtful if there is any better way than to spread the manure upon the fields as it accumulates ; there is never any more plant food in it than when it is new, and I think about the same

changes take place when it comes in contact with the soil, that take place in composting and fermenting. This method requires the least labor and it can be done at any convenient time. It is thought by some that manure so spread and exposed, will lose much of its value by drying and evaporation. But, having tried it for years, and spreading it at all times and seasons, I have yet to learn that I have lost anything but the water of which it is mostly composed. Some of the experiment stations having tested this matter report there is no perceptible loss in plant food by evaporation.

Where shall we apply the manure? I would say, to the best, nearest, most feasible arable land we have, unless it is already producing at least three tons of hay per acre. We cannot afford to go over large fields for small crops. The idea of many acres, large farms, was inherited from our fathers whose system of farming required it. But under our conditions we must concentrate our efforts on smaller areas to get paying crops. In these times of small margins, it is doubtful if it pays to raise any crop that is not grown up close to perfection, this cannot be done unless our land is in a high state of cultivation, and when it is brought up to that point, it is not difficult to keep it there if we but give it enough to do. The capacity of the soil is but little understood. But this we know, it is doing best, when it is doing most.

In the process of growth field crops evaporate a large amount of water, and this process brings out of the soil those particles of plant food which are taken up and assimilated in plant growth. Now if the field is barren, and there is no growing plants to keep up this upward circulation, then the tendency is the other way, and these particles of plant food are washed down into the sub-soil, hence the importance of keeping the soil constantly at work. When one crop is removed another should take its place. Potatoes should be dug early and the ground immediately seeded. The corn fields, when the corn has been siloed, can be treated the same way, using the manure that has accumulated through the summer for this purpose, seeding with timothy and red-top, with a good allowance of clover the following spring. In this way our soil is kept constantly at work, and if supplied with plenty of the



right material will give us bountiful crops. I think the same principle should be applied here that would govern an intelligent dairyman in the management of his herd of cows. A small herd, well fed, and kept constantly at work will afford a profit, while a large herd poorly fed, and idle a part of the year, gives a balance on the wrong side of the account.

When we consider that one acre will yield eighteen tons of corn which either as dry fodder or ensilage is equal to six tons of hay, and since it is on record that over five tons of hay have been produced on one acre, I think we must conclude that manure gives the best returns when used on our best lands. I have tried it both ways. A few years ago I made the bold strike of turning a portion of my meadow land out to permanent pasture, and found it was a strike in the right direction, for instead of getting less than one ton per acre of hay that was inferior for food and poor for manure, now we get two crops per year of hay that is rich, luscious food and rich for manure.

Six tons of hay from two acres is better, worth more in every way, than seven tons from ten acres.

In the use of commercial fertilizers, for which our State annually pays one hundred and fifty thousand dollars, it is well to consider if it is remunerative. Undoubtedly there are many farmers who can make a good showing from its use; while there is a large number who cannot tell whether its use has afforded them a profit, and here we see the importance of the farmer possessing certain knowledge to guide him in his work. He who buys and uses indiscriminately commercial fertilizers or agricultural chemicals, has poor chances of success, as compared with him who has definite knowledge of what his crop requires, and also the essential elements lacking in his soil to produce that crop. The conditions of our soil are so variable that while one field may be completely exhausted in all the elements of plant food, another field may fail to produce good crops from a one-sided exhaustion, that while some of the elements of plant food are exhausted, the other elements may be abundant. So we may see how money paid for nitrogen to be applied where nitrogen is abundant, is a loss, and the same of the other ingredients of all fertilizers. Then

---

how important that every farmer should apply himself to this question, and through his own endeavors and with the aid of the experiment station that is doing so much in this line, obtain that knowledge that will enable him to act intelligently. When the farmer has determined what his crop shall be, he should be able to compute the amount and kinds of plant food required for that crop, then he will be able to buy just what he needs and nothing more.

Every intelligent farmer will take care that there is no preventable waste of fertility and will increase the value of the manure by judiciously feeding his farm stock, supplementing the farm grown fodder crops with those concentrated foods that contain a large per cent. of the elements of plant food, and largely by exercising definite knowledge in supplementing his plant food by such commercial fertilizers and chemicals as his needs require.

## SHEEP HUSBANDRY.

---

BY VICTOR I. SPEAR, OF BRAINTREE.

*Member of the Board of Agriculture.*

In discussing the subject of sheep husbandry in Vermont with reference to the demands and possibilities of the present, we are led to consider some of the work of the State, both because it has an historic interest and because it shows the possibilities and advantages of the State for this business. Though in some minds, Vermont sheep husbandry is ALL of the past, it is nevertheless true that it occupies an important part to-day and is receiving more attention than for several years. It is also true that persons engaged in this business at the present time and working on lines demanded by the markets of the present are meeting with a fair degree of success and inclined to the opinion that it is as profitable to-day as formerly.

Though Vermont has a proud record in the matter of producing the various classes of farm animals, it is doubtful if any class has made so good a record as that left by its sheep. Introduced into the State in its earliest days, sheep were the main stay of Vermont agriculture for more than a century. From the flocks of the State came nearly all the money used in our early history; from this source was obtained the money to clear the land and build homes, to pay mortgages, maintain the large families of those days, to educate the children and in addition a fund was usually laid by from which to still further assist the sons and daughters as they went forth to establish homes of their own. Other sources of revenue of course yielded something. The butter and cheese provided many of the necessities of the household by way of exchange at the country stores. A pair of steers were sometimes sold, sometimes a colt was marketed, but the chief revenue from the farm came from marketing the clip of wool. This was the source for paying debts and for providing things needful, and not until the farmers broke away from this business did we hear any great com-

plaint of hard times, deserted farms and discontent with farming as an occupation. I do not claim that to have remained in the sheep business, as formerly conducted, would have prevented the hard times following the war and the general and great decline in prices, but in my judgment many good shepherds became very inferior dairymen and made a mistake in changing. Many farms, well adapted to sheep raising, were unfit for dairying and the owner made a mistake in changing. Much of the high land of the State is especially adapted for sheep pasturage and worthless or nearly so for any other purpose, and when the flocks of Vermont were largely sacrificed this land naturally and of necessity grew up to forest. An increase in the number of sheep in Vermont, judiciously managed, would mean increased prosperity for the farmer and increased fertility for the farm.

Vermont is the natural home of the sheep, the high, dry land of our hills and mountains makes perfect pasturage; the clear, pure water of our springs, the rich grasses from our meadows, the cold weather in the winter are all elements that enter into the perfect development of the sheep and are possessed here in so marked a degree as to have enabled Vermont breeders to have taken the lead of the world in the development of the Merino. It was not because the Spanish Merino fell into more intelligent hands in Vermont than elsewhere, that has enabled the breeders of this class of sheep to fix the standard of the world, and in all international contests of merit, to bring the gold medal to Vermont, but because combined with good intelligence, the breeder of this class of sheep enjoyed the advantages of Vermont's peculiar privileges, because Vermont was the natural home of this animal and the soil, climate, feed and water were such as to give the most perfect development. This class of sheep as a distinctive and thoroughbred animal will hold a place among a limited number of breeders for an indefinite period. The reputation of Vermont for sheep comes largely from the breeding of this class, and no business employing a like amount of capital has ever brought as much money to Vermont as the Merino sheep. Under Vermont treatment the Merino has increased in fleece from twelve pounds for the rams to forty pounds, and the ewes in

like proportion. From two to three times as much cleansed wool is now taken from our best flocks as from the original sheep as they came to us from Spain. The carcass has increased largely as well as the general form, constitution and make-up of the animal.

With breeds of Merinos our markets may be now said to be at "low tide," but remembering the history of the past fifty years a revival is expected at some time in the future. The markets for the surplus stock of this class are now found in Australia, South America, Southern Africa, and in our own new states and territories. Prices received for this stock varies from about their value for mutton to very high figures, often hundreds of dollars per animal, and sometimes a thousand dollars or more being paid for them. The demands of the trade on our frontier have made necessary an increase in size, and a sheep less wrinkled and oily than formerly bred, and in proportion as the breeders of Vermont succeed in meeting the present demands will their chances of future sales be increased. This business is confined to a small number of persons, many of whom have spent all their lives in it and know all its details and necessities, and each of whom is apt to have very definite and positive ideas as to the proper lines to work on. The Merino has demonstrated the fact that Vermont is a sheep State, and that of all breeds no other is so perfectly adapted to our conditions.

In former years sheep in Vermont were considered mainly as a wool bearing animal, little attention being paid to the value of the carcass ; by many, mutton was considered as unfit for food, and its price in market, if it had a price, was but a trifle, pork and beef being the favored meats and selling at a very much higher price. Gradually mutton has grown in popular favor, and for the past few years the market has been reversed from its former condition and mutton has become the favored meat, selling at a higher price than either pork or beef—spring lamb mutton in the months of April and May bringing extremely high figures. Each year has brought an increased demand for mutton, and especially lamb mutton, and it seems probable that Americans are very soon to imitate their English cousins in preferring it to any other meat. It is claimed, and is probably true, that there is no meat so wholesome, healthy and palatable. The great preference shown this meat

in recent years has opened up new possibilities in sheep husbandry and a line of work especially adapted to the common farmer, one in which the income from year to year may be calculated with great certainty, and in which the variations from year to year are small. While it may be said that the breeding of thorough-bred Merinos is adapted to the few and is subject to great variations, it may be said that the mutton sheep is adapted to the many and is very constant in its returns. By means of marketing the lamb for mutton, the increase becomes more valuable than the fleece, and those in the business receive from \$4 to \$8 or more per head income from each sheep, many reporting very much in excess of the larger figure.

In keeping sheep with a view to the value of the lamb for mutton, one is not confined to any particular breed. One should consult his surroundings, and peculiar conditions and then choose that which is best adapted to the case. In small flocks of less than fifty it is probable that some of the larger breeds would yield the greater profit. The Shropshires, Southdowns and Cotswold are all well adapted for the purpose; lambs from either of these breeds may be raised early and made to weigh fifty pounds or more the first days of May, and when so raised they command a high price. To raise them at this season requires warm barns, liberal feeding and involves quite a heavy expense both in feed and care and only a comparatively few persons are situated to do it with success. Lambs dropped later and ready for market from first of July to first of September are raised with less expense and care and though selling at a lower price are considered by many as equally as profitable as the lamb marketed in May. Many of these later lambs are carried along and fed grain the following winter and sold in December and January.

For flocks to exceed fifty in number the grade Merino has many advantages over all other breeds. They are adapted to run in large flocks, are peaceable in pasture, hardy and free or practically so from disease or trouble from vermin. They mature more slowly than the larger breeds and live several years longer. The fleece of the Merino, by reason of its largely increased weight,

brings a larger return than other breeds. As now bred, the lambs from the Merino may be made ready for market during the winter or when eight to ten months old. To do this requires good care and that the breeding be from large sized animals. A middle course is quite largely followed, using grade Merino ewes and a ram of the largest breeds. Perhaps more of the lambs that go to market are bred in this way than in all others and results have been very satisfactory. The objection that the ewe will not afford sufficient milk for the half-breed lamb is a valid one, and has to be overcome by giving the ewe extra feed, or by supplementing with cow's milk. In some cases the expedient of having the lambs dropped after the sheep go to pasture is used, and this is an advantage. In any of these various ways, sheep are a profitable stock to-day in Vermont and the exact line each shall follow is to be determined by circumstances, since it is found necessary to use such sheep as are in a community as the expense of bringing from a distance would deter one from undertaking the business.

Fortunately for the shepherd, I know of no other animal which crosses and recrosses without being entirely ruined as can be done with the sheep. So that given poor breeding stock fair results may be obtained by using a good ram and giving good care and feed. It is a better policy to breed without wide crosses if possible. Merinos bred to large sized Merinos of mutton Merino type will give a more even and better result if the future of the flock is to be kept in view, and the same may be said of the larger breeds. Wide crosses produce uneven progeny and I only justify it in cases where the lambs are to be sold for mutton. It matters little in this case whether the lamb is like its sire or its dam, it is wanted at so much per pound. I know of many flocks of grade fine wool sheep that are kept in Vermont to-day that do not return over one dollar per head for fleeces and about the same for the lamb, if successful in raising one. For such cases violent treatment is necessary, and I know of no way to get a profit from such stock except to cross to the mutton breeds. On the other hand there are grade flocks of the larger breeds that will only shear from three to four pounds per head. A cross with the Merino is the only way to improve the fleece of these sheep. So, though theo-

retical, we may say that wide crosses should be avoided. There are practically many cases where I should feel justified in recommending that it be done.

The sheep is considered by some to be the negligent farmers stock, and in some seasons of the year it is true that they need but little attention. It is likewise true that at other seasons they require the most exacting care and attention. After the 25th of May, sheep are usually in pasture and need little attention, except a weekly visit with some salt until weaning time for lambs. Lambs should be separated from the ewes from the 15th of August to the 1st of September, and put into good feed and taught to eat a little grain, and whether the lamb is being fitted for market or to be kept in the flock, the grain ration should be continued until they come to the barn for the winter. Then if hay is of nice quality the grain may be left off, or better replace it with some feed of a succulent nature, such as roots or ensilage. The treatment outlined for the lamb is likewise suited for the mother. As soon as feed becomes frosted, and sooner if the supply is not abundant, a grain ration should be supplied and continued until the sheep are in their winter quarters. It has been said, and it is nearly true, that "sheep coming to their winter quarters in good flesh are half wintered." If I had grain for my sheep sufficient only for one month, I should prefer them to eat it from the middle of October to the middle of November. A small amount of grain fed with regularity is a great benefit to a flock of sheep. For grain there is nothing equal to oats that I have ever fed, but in consequence of the expensive character of this feed, I substitute bran and corn or corn meal and like to use a portion of oil meal. I also feed roots, ensilage and apple pomace, either of which serves the purpose of affording a succulent food. Am of the opinion that corn ensilage is superior to roots or pomace, though my experience is not yet sufficient to make me feel any great confidence in my opinion on this point.

Sheep need to be fed with great regularity, twice a day is as good as more, but the feed should be forthcoming at the expected time. A clock is hardly more accurate as a time-keeper than a sheep. Have often looked into my sheep-pens half an hour before feeding



time and seen them all lying down contentedly, chewing their cuds, within the next half hour every sheep would be on its feet looking anxiously for their feed. With Merinos they may be kept in flocks of fifty in the winter, care being taken that weak ones be kept by themselves. With the larger breeds a less number should be allowed to run together, twenty-five being as many as I would recommend for a pen. During the lambing season the shepherd will have plenty to do. If the sheep have had grain through the winter they will bear a little addition at this time. If they have had none it should be fed at this time in small quantities and with great care. Where grain is not fed through the winter it is well to commence feeding three or four weeks before lambing. If provided for them, the lambs will commence to eat grain at one to two weeks old, and their growth is increased by this means.

From the middle of April to the first of May the sheep should be shorn. This should be done two weeks at least before turning the sheep to pasture in order that the ends of the wool may close up and the fleece get a little new growth to serve as a protection when turned away to pasture. The old custom of washing sheep and sheering about the 1st of July has so nearly gone by that little needs be said in reference to it. The markets at the present time demand unwashed wool and it is bought on a basis of what it will clean and the person who washes his sheep is likely to get but little if any increase in price over his neighbor who does not wash. It is unkind to the sheep to be made to carry its fleece through the warm days of May and June and then be stripped of it only to have the hot sun of July scorch the exposed skin. Sheep shorn early thrive better, and the shepherd gets more for the wool than those washed and shorn late. There is no reason for continuing this practice and I hope soon to see it entirely abandoned.

Having passed over briefly some of the points that I consider essential to successful sheep husbandry under our present conditions, I have not undertaken to lay down rules to govern all cases, which would be manifestly impossible, but to indicate my conviction that sheep husbandry is full of promise to Vermonters. While

---

not displacing any of our other work it may be made a part of the economy of many of our farms with great profit, and in many sections may be carried on successfully, where other stock could not. So far as it is adapted to promoting the best interests of our farms and our farmers I hope to see it receive the attention it merits.

## THE CARE OF DAIRY CATTLE AND THEIR PRODUCT, MILK.

---

BY W. W. COOKE OF BURLINGTON.

*Member of the Board of Agriculture.*

The subject will be taken up in the order in which it is stated. First, the care of the animals; and later the care of their product. In the care of the animals we need first of all to look after the animals' health. I take it that this is not enough thought of in a good many cases at least. If you were to go round in the back country and examine the barns in the establishments there—and the stables, too—you would have it impressed upon you that certainly not enough care was taken of the health of the animals. There is no use in endeavoring to get good healthy milk, such as you would want to make into butter for use on your own table, or such as you would want to feed to your own children, out of cows unless they are kept in the very best of conditions. That is one side of it. Then, the other side is that you cannot get the largest quantity—considering it from purely mercenary motives—you cannot get the best returns financially unless you can keep your cows under the very best and healthiest conditions and those healthy conditions should apply to everything that appertains to the care of the cow, even to pure air to breathe.

Now, pure air costs money. It is a great deal easier to take barns and shut them right up tight, and keep the cows warm by confining the air there; it is a great deal easier, and a great deal cheaper to keep them warm that way, than it is to have a circulation of air, to have a large quantity of air go through, all of which has been warmed. Fresh air costs money, and yet it is a necessity if you are going to keep those cows in health. But the fresh air ought not to blow on the heads of the cows; it ought to come from behind and not blow down upon their heads. I have been in many barns where the only ventilation was down

through a hole, the air coming right down on the heads of the cows, which is very likely to produce sickness, especially if the cow has been weak before. The ventilation should lead from the rear of the animal, forwards.

It is quite easy to make a rational system of ventilation. Most barns have very large studdings running up and down, and it is a comparatively cheap method to build a ventilating flue right in the side. If it is a modern barn you can enclose a space between the studding, and make an air chamber from four to six inches one way and from 18 to 24 inches the other way, according to the distance you have your studding apart. This can run up to just under the eaves, and in that way you can get a circulation of air with very slight expense. There is no excuse for not having good fresh air in the stable.

I do not need to press upon you the necessity of having pure water for your cows. Probably but few of you will ever furnish anything else. But, we had it impressed upon us last summer that even when a man was furnishing an abundance of pure water, he still might get into trouble from his cows drinking impure water. You remember that last summer was pretty wet. We had several cows come to our attention that would drink stagnant and impure water, though they had an abundance of the best and pure water. Drinking that stagnant water produces a feverish condition in the system. It is not only necessary to furnish pure water, but it is in these exceptional cases necessary to prevent the cows having any chance to get impure water.

As to the temperature of the water. I suppose it is not necessary in this part of the country to discuss the question of warm water. There is a very small portion of the year when the water is so cold as to require warming, so that there will not be any need of warming it. In our country, up among the mountains, it becomes quite a question, and yet even there we have to water the cows with pretty cold water. This seems to be a question of warm barns, warm or cold barns, rather than a question of warm or cold water; that is, if the cow is in a perfectly comfortable barn, where the system is not fighting cold at all, she will do just about as well on cold water as she will on the warm. I do not mean by cold

water, water that has ice in it, but water of the ordinary temperature as you find it in our troughs, wells or springs in winter, which will be somewhere in the vicinity of 38 to 40 degrees. There are a few cases where the cows have to go out to drink from running streams that in January and February become filled with anchor ice. Water with anchor ice in it is actually colder than freezing; it is a good many degrees colder than frozen water, because the little particles of ice have to absorb 70 degrees of heat before they get warmed up to freezing. When your cow takes these icy particles in its system it takes in a good deal of cold and there can be no doubt that in such cases it would be economical to warm the water; where you can it will pay you to take water from 38 to 40 degrees of warmth, and if colder than this to warm it. If the barns are comfortable no financial benefit would be attained by warming the water, if on the contrary the cows are fighting the cold, if the barns are only moderately warm and the cows have to go out quite a ways to drink and then are left out doors for hours after they drink to shiver and fight the cold, then every particle of warmth you can get into those cows is just so much an advantage.

In addition to the warmth in the barns, for the best results you should have plenty of light. It may seem but a little thing to allow the sunlight to stream into the barn, but experiments with cows on the south side and on the north side show different results. Sunlight is healthy to the animal system and the best results will be where it gets more or less of the direct light. Do not be afraid of putting several windows on the south and east side of your barn. It costs but little and the window frames can be put in tight enough so as not to allow too much cold to get in, during the winter. It costs but a few cents to put rubber strips around to keep out the cold and extra light has an actual financial value in such a stable.

When we touch the question of amount of exercise that cows need in order to keep healthy, we find there is considerable difference of opinion. I remember hearing one of our best dairymen claim that he would not have water in his stable if any one would put in the apparatus free of charge, so that he could have a stream

running there the whole year round. He would not take it as a gift, for he wanted his cows to go at least forty rods out to the stream to drink so as to get exercise and be compelled every day to get that amount of exercise. I was very much pleased in visiting the same man, not many months ago, to find a watering trough in his stable, and I asked him if he remembered making any such remark. He said "Yes." I asked him how he made the two agree—his theory and his practice. "Well," he said, "I have learned some things in these years since." And so it is with a great many farmers, they are learning that cows do not need so much exercise as formerly was supposed.

In Wisconsin a few years ago Hiram Smith had a large herd of over 100 of the choicest Jerseys. His cows never stirred out of the stable from the beginning of winter to the end. They were scarcely out during the summer. There is a herd on the other side of the ocean that neither it nor its ancestors have been out of the barn for the last 25 years. That is, the herd was put in the barn 25 years ago and it and its descendants have been there ever since. There is 25 years of no exercise and the cows are still doing well, so far as one can see, and are still healthy. Well, now, these are facts that show the possibility of a cow getting along with a rather small amount of exercise. I should hardly want to go to that extreme and advocate keeping the cows in twelve months of the year, but from my own experience I am willing to advocate the keeping of the cows inside the barn doors from the time they are put there in the fall until they are ready to go out to pasture in the spring. If you are required by the conditions of your water supply to turn them out to drink, why, do so, but turn them directly back into the barn.

If the cow has had her food during the summer and goes into the barn in a good healthy condition, her system will not be injured at all by standing in the stable for 200 days with no exercise excepting that of chewing her food. Of course you take good care of them. You should not let them stand there 200 days without care. But if you will do your part they will do theirs, and go out in the spring in good condition. Our cows

are just finishing out their second year in that way. They are a great deal better now than they were a year ago after keeping them in the barn. This winter they have not put their noses out of doors since the first of October. I doubt if you can find within fifty miles of us any cows that have gone through the winter in any better condition, or that are more ready to start right out on the spring's work. They certainly have done well; they have a good hold and bid fair to make a good summer of it.

I had my attention more particularly called to this subject because in experimenting on the cows we found it absolutely necessary to keep them in the barn in order to get an even milk flow. If the cows were allowed out of doors three or four times a day during bright days, then when there came stormy weather they were uneasy. It would not do to turn them out; it would injure them to turn them out; and they were uneasy in the barn waiting for some one to come and turn them out. There was a variation in the quantity and quality of the milk. Now when they come in and stay in right through the winter there is none of that at all. I never saw a more contented set of cows; they do not seem to care anything about going out. We have opened the door to see what they would do and they would go and look out and then turn around and go back. They do not seem to care anything about going out of doors. When the cow goes out of doors during most of the winter there is a colder temperature there than the temperature of the barn, and the cow's system, during the time she is out of doors, has to make more heat in order to keep warm, and your pocketbook has to pay for the feed. Then it is certainly economical to keep her there, for she will make a good amount of milk by being kept in the barn through the winter, a greater amount of milk than when turned out every few days or part of every day to fight with the cold.

It is customary to think of the dairy cow as a machine in which you put so much food, which the cow grinds and gives out as so much milk, just as the manufacturer of cloth puts through his looms so much wool, and handles it in a certain way and turns it out as so much cloth. Well, it is all right to think

of the cow in that way if you will consider that the manufacturer of cloth does not expect to get any better cloth than he puts in thread ; he does not expect to get any more cloth. If he wants a first-class quality of cloth he expects to put in a first-class quality of thread ; if he wants a large amount of cloth he puts in a large amount of thread, so in that way it is all right for us to think and to act as if the cow were a machine. But remember, we can not get good milk out of her unless we give food to her ; we can not get a large amount of milk out of her unless we put a large amount of feed into her. But it will not do to carry that simile too far between the food and the milk and the cloth and the yarn. The cow is a machine but she is a living machine, and it will never do for us to forget that there is life feeling and sensibility. The feelings of the cow have an actual commercial value. You cannot get the best returns out of the cow unless she is thoroughly contented. I should lay that down as one of the factors of the proper care of the cow, that she be perfectly contented. Several things are then required ; one is that she must relish her food. It is just as necessary to know what food the cow likes as it is to know what she does not like. The food she likes she eats more of, and you can get an increased amount of milk from it—from the extra amount consumed. And then, it is a fact, it may be a mere coincidence but it is a fact, that those foods which are most relished by cows are also best digested. You take grain, young corn fodder, roots, and things of that kind that cows are very fond of and you will find that at least three-fourths of that food is easily digested.

Then, the cow must be well treated in order to get the best returns from the food. This is one thing in which a man's own selfishness ought to teach him to do good, for you cannot abuse the cow in any way, shape or manner without paying for that abuse, and right out of your own pocketbook. Every time you strike the cow, every time you abuse her in any way will tend to lessen the product of that cow. That is no theory. It is a fact. Some people have even gone so far as to say that the cow had an unlimited command over the quantity and quality of her product ;



that she, by the mere exercise of will power, could determine the amount and the quality of her milk without any regard to what food was given her. I should hardly want to go to that extent and make a statement as wide as that, and yet that statement is made, and probably it is true that the quantity and quality of milk that is given depends more on the mental state of the cow at the time she is being milked than on the food she has eaten during the preceding 24 hours. I think that statement will bear the test, that the quantity and quality of milk given at any (one) milking depends more on the condition, mental condition, of the cow at the time she is being milked than on the quantity of food that has been consumed during the 24 hours previous. If you doubt whether the mental state of the cow has any effect on the milk, just let me call your attention to this fact, which you can tests for yourself at any time, and you will see that the mental state of the cow does have an effect. First take samples of the milk for two or three days and analyze them or churn them so that you may know the general character of the milk the cows are giving—and then, just before milking, go in the stable and fire off a revolver a half dozen times in front of the cows. Then sit down and milk, and you will find you will get less milk and it will be quite a good deal poorer in quality. Now, that must come from the mind, because you have not touched the cow—you have acted on no part of the cow except her mind, and you will find a very decided effect on the milk. Dr. Babcock, of Wisconsin, has been making a lot of experiments in that same line, to find out the effect of the mental state of the cow, and it is surprising how small a thing will influence the product.

My doctrine is that the cow should stand in the stable every night in the year but that of course is at variance with the practice of the majority of dairymen. There is probably not one farmer in twenty in Vermont that stables his cows every night in the year. But it pays; it pays in several ways. It pays particularly in the amount of manure that is made during the year. Within the last few weeks I have had occasion to figure up the amount of fertilizer that is wasted by turning cows back into the pasture at night. You may say it cannot be wasted because it

goes on to the pasture, but experiments have shown it is. A large number of farmers have tried both ways and are agreed that a given amount of manure dropped on the pasture by the cows is not more than half as much in value to the farmer as that same manure deposited in the barn where the farmer can put it on whatever land he desires. It seems to be a fact that you do not get as much return from your manure when it is scattered irregularly over the pasture as you do if you have it where you can put it where it is most needed. I think it is a very liberal allowance to say that it is not more than half as valuable in the pasture as in the stable. You see then that if they are turned back into the pasture over night, a quarter of the total amount made by these cows during the summer is wasted. Figure the amount out for yourself. For the cows that are in the State of Vermont, it makes over \$120,000 worth of manure a year that is wasted, just wasted, and needlessly wasted. It will be seen then that the manure will very much more than pay for all the extra expense if they were put in the stable during the night. But there is no extra expense; it is on the other side. By stabling the cows you have them there for the morning and you save a good deal of time in getting them together to say nothing of the worry of the cows from being brought in. There are lots of herds for which men have to start out at half-past three o'clock in the morning to get them in from the hillside and down to the barnyard for milking. That is hard on the cows; it is hard on the men. It would be a great saving to keep these cows right in the barn.

It will take some more hay for the cows when they go to the barn at night if they are going to be kept there during the night. But the cows should have what hay they can eat. I should lay it down as a rule that at any time in the year when a cow is willing to eat she should have what she wants no matter if she is just fresh from the pasture, she should get all she wants. If she is willing to eat, by all means give it to her and all she wants. In our own case we feed but twice a day. I do not know that I should want to advise everybody to feed twice a day. You do not have to go back more than twenty years to find farmers feeding all the time, keeping something in front of the cows from about four

o'clock in the morning until ten o'clock at night, beginning to feed the first thing and keeping it up all day. But they have gradually narrowed down the number of times of feeding until now it is confined to two or three times. I do not mean by that that food is offered to the cows but twice or three times a day, but that there are two or three general feeding times.

You may say "we feed in the morning and night, and yet give the morning meal in two different portions or the evening meal in two different portions, so that we can give the food to the cows three or four times a day." You may have meal, ensilage, hay, corn, and feed the meal on the ensilage the first thing in the morning before you milk, and then after you get through milking or after you come out from breakfast you may give them hay and after that give nothing until you milk at night. That is the way we feed at the present time and that is what we call feeding twice a day although the food actually given them is the day's feeding in four different parts. We feed twice and water once a day, at noon. Whether cows should be watered once or twice is a question of habit. The cows can be educated to drink twice or they can be educated to drink once. I think there is no need of watering them more than once a day when they are on ensilage. If they were on entirely dry fodder there would be very little choice between watering once or twice a day.

So much for the care of the cow. Now, what shall you feed that cow on?

That, I take it, is one of the biggest problems that come to the farmer. You go back to the methods of dairymen as practiced all through New England fifty years ago and the question of cattle feeding was one that required no intelligence whatever. The raw foreigner could feed just as well as the best educated Yankee. The cows were turned out in the pasture in the spring and had what they could get from the pasture until they came to the barn and then they had what hay they wanted to eat and nothing else until they went out to pasture again. That was the sum and substance of feeding them. That at the present time is the whole practice when you get up into the hills. But the farmers who

practice that are not those who are making any money out of farming.

The changes from summer dairying to winter dairying brings in here the problem of feed and makes it an important one, and I suppose it is true that at the present time it takes more headwork to successfully feed a crop than it does to raise it. In feeding I would propose that the cow should be full fed every day in the year. If you want to starve the cow, wait; don't starve her this year; wait until you have turned her off for beef. By full fed I mean not only all the coarse fodder that the cow will eat but some grain. There are very few days in the whole year that the cow will not return it, though there may be times when she is dry. Give grain feed to her and if she goes dry two months out of the twelve there may be one month when she will get along well without the grain. Cows will pay for their grain during that month. Of course you do not need to feed heavily on grain when the cows are out on good pasture, but even on the best pasture two or three quarts of bran a day is a good investment. I think it can be said that that extra grain to the feed on the pasture is almost entirely recovered in the milk pail. We do not grain heavily. We consider six pounds of grain as a full day's feed, because under our conditions grain is expensive and hay cheap. But even with expensive grain and cheap hay we find it profitable to feed bran at least through the whole of the summer and the moment the pasture begins to fail, in July or August, to begin increasing the grain until by the first of September the cows have nearly as much grain ration as they have in the middle of winter. We find that it pays. We find when we come to figure it up at the end of the year as to how much the cow has given, that there has been a large amount of profit. But the cows then hold out and run longer, and we very often have trouble about drying them off. Especially is this the case about the first of September. This continuous full feed on grain has a double profit. You not only get the profit of the dairy, of the product in the increased milk, but you get the added product of the general development of the animal. That is especially true with young animals. You take a heifer with her first, second or third calves and full feed her for the rest

of her life even on moderate feed, and she will give a great deal more than if she had not been developed. It tells and tells largely in the feature of usefulness of the animal.

But I want to caution you right here not to begin that heavy feeding too early in the life of the cow. There are many first class cows that are ruined by over feeding. Just think of it; here we have two general classes of cows, the beef cow and the dairy cow. The beef cow is taught by her breeding, by her ancestors, to be a miser, to save up and put into her system all the food you give her and not waste any but keep it and make it into flesh. The dairy cow has been educated by her breeding to do just the opposite. She is educated to give, and the best dairy cow does give just as long as you put any feed into her. A first class dairy cow can never be fattened so long as she is giving milk. If you want your heifer calf to grow up to be a first class dairy cow you do not want to educate her to be a beef cow during the first years of her life. Yet that is the general consequence hundreds of times in the case of fancy stock, especially when they are intended for the shows and taken to the fairs to get prizes. Over-feed the animal and you teach it to lay on flesh when that is just what you don't want to do, so that during the two first years of the heifer's life you want to be careful not to over-feed. Feed full rations but let the feed be for making muscle and making bone and building up the system of the animal, and not for making it fat. I never like to see an animal fat before it begins to give milk. The dairy cow should never be fat at any time unless it is just before she calves. I rather like to have a cow in pretty good condition, almost fat, just before she calves, and then she can dry off her system for a week or two until she gets on to her food and gets on to milking, and not getting too thin. The good dairy cow ought never to fatten no matter how much you put into her. We have a cow in our dairy now that you could never fatten, its ribs would stick out just the same. This cow has been educated to be a dairy cow and not to grow fat.

It is necessary, of course, for the best results, that the feed shall be healthy. There is a point that cannot be touched by chemical analysis. The chemist cannot tell you whether the food is going

to be healthy or not, and he might get into serious error by relying on the chemical analysis alone. For instance, in the case of corn meal and cotton-seed; the chemist says that corn meal is rich in starch, which is the heat-producing part, and deficient in flesh-producing. The analysis of cotton-seed is just the other way, it is abundant in flesh-producing and poor in heat-producing qualities. The chemist says that these together will make a perfect ration, each one adds to the other and you have a good ratio. But none of you would ever think of feeding your cows on nothing but cotton-seed and corn meal because there is another principle there that the chemist cannot get hold of and that is the tendency of producing fever. The farmer says it is too heating. There are more cows ruined by too heavy feeding with these heat-producing foods and these heavy grains than by all other reasons combined. When I find a cow has the garget, the first question I ask is, "how much corn meal do you feed to it?" And in two out of four cases it is traced to heavy grain feed and to an improper mixture. I lay it down as a rule that grain feed should be one-half by weight, what you farmers call light grain—you speak of light grain and heavy grain. The light grain would be bran, middlings, 'round oats or shorts, and the heavy grains, corn meal, cotton-seed and gluten—and you want the ration to be one-half of it, the light grain. That is, if you are going to feed a mixture containing three pounds of corn meal and cotton-seed meal you should feed at least three pounds of bran, middlings or ground oats so as to keep down this feverish tendency and work off the heavy grain and keep the digestive system in good condition.

The fodder should not be too bulky. That you have learned; you cannot expect a cow to do her best unless she has some concentrated food. Take clover for instance. Clover hay is a perfect ration. You can never expect a cow to make two pounds of butter a day on nothing but clover hay which would require thirty or forty pounds of it; the mere work of chewing it, digesting it, would be a draft on the system, and she would not have any energy left to produce milk or butter. When we want an extra production out of a cow, we must furnish grain in a concentrated and easily assimilated form and make the work of digesting it

as light as possible, if we are to have the best results. It is an unnatural condition to put cows in a barn in October, and then keep them on nothing but dry food until they go out to pasture. Those who have tried it are almost unanimous in their testimony that the cow does better, keeps in better health, keeps up the milk flow if her food is moist.

The food should be of proper proportions between the heat and flesh producing food, but I will not undertake to go into the matter; it will take too much time. I will merely say this: probably here in Vermont where the coarse fodder is so cheap that a ration a little wider than the German standard ration will be your most economical one, that is a ration one part flesh-producing, albuminoids, to 6-7 parts heat-producing—that is, starch and sugar. The farm fodders, clover hay or ensilage, Hungarian hay or ensilage, millet and rye cut just before the head comes out of the stalk are foods that do not need the addition of any grain to balance them up but make a perfectly well-balanced fodder. If you are going to feed largely of corn in any of its forms, as corn-meal, fodder ensilage or corn-stalks—the corn plant in any way is a one-sided fodder, and needs to have added some concentrated element like cotton-seed meal to balance it up in order to make it correctly proportioned.

In discussing the question of milk, the first thing that needs to be insisted on, is cleanliness. Out of more than fifteen milkmen that I am well acquainted with, there are less than one-half of them that come anywhere near what you would call the standard of cleanliness. It seems to be exceedingly difficult for a human being to handle milk with perfect cleanliness in everything, and to get it to the customers without the slightest shade of bad odor. If you are to get the best returns, if you are to have healthy milk and have a trade that will stand by you through thick and thin, you need to have cows that give a medium quantity of milk and not look for the cow that gives the biggest flow. You do not want cows that only take two or three of them to run a saw-mill, but you want the cows that give what might be called a medium quantity. You would not think of putting on your

farms the highest grade of Jersey cows that take thirteen pounds of milk to make a pound of butter. There is no necessity of that; public taste does not demand that quality of milk. The public, however, does know good milk, and when they have once drank it they are willing to pay more for it, rather than go back to the thin blue milk. The Massachusetts law requires 13 per cent. total solids, and that is not a bit too high. No man ought to keep cows who would give any less than that. But the average composition of the milk produced in the whole State of Vermont, is a little above the Massachusetts standard. It will run 13½ per cent. and very likely in some towns 14 per cent. is the average of the total solids of the milk in this State, and that being the fact there is certainly no reason why Massachusetts and other States cannot get milk that is 13 per cent.

It is not necessary that you should have cows that give a small amount of milk, because cows can easily be found that give moderately large quantities of a good quality of milk. I think if you take the dairy right through, you get a larger return and better quality from cows that do not give an extra flow during the flush of the season; that is, you get more solids in the year out of the cow that does not give a very large quantity but holds out pretty well, than from one that, when she calves, for four to six weeks it takes two pails to milk her and then is inclined to run down pretty rapidly for several months; these floods of milk are always thin milk. There never yet has been a fine cow that would give an immense quantity of rich milk although some cows do give marvelous quantities of milk. Large quantity means low quality.

It has been generally supposed that the Jersey was not the milkman's cow. She did not give milk enough. The Experiment Station has four grade Jersey cows that have had each one calf during the last twelve months and most of them have calved twice, so that they have had their full year. They have given, one 5,471 pounds of milk, a second 5,946, another 5,964, and the fourth 7,645, being an average of 6,281 pounds or pints of milk during the last twelve months. It takes pretty respectable thin milk cows to do any better than that and these cows have given



good milk, milk that averages for the four cows 14.75 per cent. total solids. So that you see it is possible to get grade cows that will give good milk and in good enough quantities to make it a paying investment to sell it as milk—that would make at least 7,000 pounds of milk, Massachusetts standard of 13 per cent. total solids.

There is a chance in a great many cities in New England for somebody to start in and make a good paying business out of furnishing milk, just about that quality of 14.75 per cent. of total solids, milk that will take from 18 to 19 pounds to make a pound of butter—selling it as extra good milk in pint or quart bottles and getting an extra price for it. There are quite a number in Vermont that make a good business out of it and get from one and a half to two cents a quart more than the ordinary run of milk. These cows of ours are common grade cows that fetch a price somewhere about \$40, so that it is not necessary that you should have thin milk in order to have a good paying quantity.

It is necessary to be very careful about preparing it before it is put into the cans. The milk must be cooled, but of course more attention should be paid when aerating it. I doubt if one milkman in ten has a regular good arrangement for airing his milk. Most of them take a dipper and stir it up or pour it out a little at a time or pour it from one can to another. But it pays to give some attention to this point and it is not an expensive business. You can make or have made for you for a very small sum a machine that will do very nicely. Suppose you want to strain your milk into cans with a small mouth, say  $3\frac{1}{2}$  inches across; if you can put above that a funnel so that it will widen the mouth to about 16 inches, then put over that a pan of the same diameter having a ring of holes on the outside and strain your milk directly into the upper pan, then as it falls through these holes it falls in a thin ring only on the outside, giving the air a perfect chance to get all through the milk. If these holes are, say a little larger than the head of a pin, a ring of them around the outside of a 16-inch pan will allow the milk to run quite rapidly, and the distance of about 15 inches of a fall will be allowed before it strikes the funnel and this will be sufficient to cool it and to air it quite

thoroughly. This apparatus is not patented and any tinman can make it for you at a very small expense, and you can strain it in that way where there will not be any strong wind blowing against it. You will find that this will help you wonderfully in cooling the milk. Milk as it comes from the cow is quite thoroughly laden with what we call gas and the more you get out the better for you. If you put the milk under the air pump and pump out the gas in it you would get milk that would keep for a long time. To convince you, just take a snuff of that air in the air pump and you will realize the necessity of airing the milk; you want to get rid of it as soon as possible after it comes from the cow. In the retail business you will have a great gain by airing the milk thoroughly before you put it into the cans for cooling.

## IMPROVEMENT OF DAIRY CATTLE.

---

· BY W. W. COOKE.

There is one improvement that lies back of the improvement of the cattle and that is the improvement in the dairyman ; if that improvement has not taken place, no improvement can be expected in the stock ; but given the improved dairyman, given a man thoroughly in love with his subject and willing to bend all his energies toward it, then we can hope to obtain an improved breed of dairy cattle.

Now that improvement will take place by the workings of three lines of effort, one, through breeding ; another, through feeding ; a third, through selection.

Leaving for a time the principles and laws of breeding we may come to the practical application of the part of this business in which the farmers of the present time are least apt to do their best. I think there is no one part of breeding which at the present time is so much neglected as the proper selection of the male animal.

Dairymen will do very well to copy after the horse breeders. If the dairyman would consider what he knows of how the horse-men breed for the working up of a first-class trotting horse and will then put the word "dairy stock" in the place of the word "horses" and use those same principles and use that same practice, we would see a very great and rapid improvement in the dairy stock of this country.

We all know that the horseman is especially careful about the male ; he is careful of course of the female ; but having a good mare he does not pick out the first stallion that comes along and expect to get a good trotter out of hit-and-miss breeding ; we must select a bull just as carefully as we select the cow.

You dairymen are at a disadvantage as compared with the horsemen. The horsemen take the stallion out upon the track

and test him to see if he can trot. If he shows the amount of nervous energy that they want; if he can go round the track and shows level-headedness and can go and go again; if he shows stability, strength and muscular development, then he is used for breeding; until he has shown that, the breeder is very shy about using him.

We cannot test our dairy stock in that way; it would be a great advantage if we could. But we can come a little nearer to it than we do by using a good deal more of our intellectual faculty, by more attention to the specific characteristics of the animal, by tracing out the breeding qualities that lie back of that bull.

Any man that starts out to improve his dairy has a type in his mind that he prefers; it may be beef, it may be milk, it may be butter. He has a type in his mind that he is breeding to secure. To improve that stock, the male animal must have been bred from a line of cows that has been exactly the type of cow to which he desires to attain. The mother of that bull must have been an animal closely approximating the type in his mind, and the sire of that bull must be from a cow having the same qualities. If you can carry that back five or six generations all the better. It is imperative that you have two or three generations. It is not enough to know that the dam of that bull was an excellent milker; her excellency may have been the result of accident. If you cannot trace in her ancestors that same excellency, you have reason to doubt whether she is possessing the pre-potency to carry that quality into her offspring, so that you want to have both grand-dams first-class dairy animals in the line that you are breeding. Then in addition to that you want good characteristics in the animal himself. This has been impressed very strongly upon me in the last few years. Our State we call a dairy State; I know there is no State in the Union so thoroughly a dairy State as Vermont. You would suppose that if anywhere attention were given to breeding it would be in Vermont, yet in going round our State I have been impressed with the poor personal character of the bulls that are being used. They come from good dairy cows—that part of the problem seems to have been well worked into the ideas of our dairymen, you could find hardly a person using

a bull that did not come of a good dairy cow. In many herds these cows are used entirely for butter ; but you will find the animal standing at the head of the herd to be of the beef type, he has not a particle of dairy type in him, and yet he comes of a line of good dairy cows. Where is the trouble ? The probability is that the animal was spoiled in bringing up. We have two kinds of types—the beef type, that is bred to save its food and store it up in its body, and the dairy type, that is bred to give from its food into the milk pail. You can take an animal of the milk-giving or butter-giving type and you can teach him by injudicious feeding, to put his food on his body, to make a great mass of flesh, and he will certainly carry that tendency through to his offspring.

If you want stock to produce butter or milk, you must raise your stock on the kind of food that the animal requires for that purpose ; feed it for growing bone, for growing digestive organs. I want the bull that stands at the head of your herd to have the form of a first-class dairy cow—of course modified, but still having the dairy type, the soft, yielding, yellow oily skin, fine silky hair, loosely built back bone, broad mouth, good escutcheon, large milk vein, in fact a well built dairy cow with male characteristics instead of the female. When you get home you take a cow of the best dairy type and set it side by side with the bull at the head of your herd, and see if you have a dairy type or a beef type for your stock animal, and unless yours differs from most dairy farms I have visited you will find that you have not the right or dairy kind of stock animals. I think this is the line that wants more attention than any other in the improvement through breeding of our dairy stock.

There is one other thing in which we ought to copy after the horse-men and that is in the testing of our animals. Here we have "Axtel" sold a while ago for more than a hundred thousand dollars because he trotted with a certain speed at a certain place. No one calls in question the record of that horse, of his having done that particular work at that particular time ; why ? because it was recorded by outside impartial judges and so done and in such a way that there could not be any possibility of doubting the record. Now I

say we never shall get on a proper footing in the breeding of dairy stock until we bring their tests right down to that same basis; until we get away from the whole scheme of *unofficial* tests, made by parties interested and which go on record to affect the selling price. The whole system is wrong. The sooner we come to a system of accurate, well substantial tests, that will be above suspicion, the sooner we shall have data by which we will *know* what we are doing in breeding. I am happy to say that dairymen are coming to realize this. One of the dairy breeders' associations has inaugurated a system of advanced registry, requiring for entrance not only pedigree but a certain amount of product per day, and this product to be tested by chemical analysis.

I take it that this is one of the longest steps in advance that the dairyman has taken; all testing should be a test of the animal, an endeavor to ascertain the actual product given by the animal, not how much that product can be manipulated and extended by interested parties. We do not want to know what the man can do but what the cow does. A man may have a watch constructed so as to take seventy seconds to make a minute, and then trot a horse by that time and make a fine record, but what good would it do? We do not want to know what the watch can do, that is a mere juggle, but what the animal itself can do. We must not be satisfied with a test for breeding until we get to the actual milk, milk solids or butter fats as given by the animal.

In talking on this subject I have advocated the use of pure bred animals, and almost every time, as soon as the discussion begins, somebody jumps up in the audience and says, "Now I have tried that and did not have any success; I don't believe one word of it; I had a herd of good common cows, and somebody advised just as you have, and I tried it. It was more than five hundred dollars out of my pocket. My dairy went down under that pedigreed sire and it has taken several years of hard work with my grade bulls to get back to where I started."

This is rather dampening to the ardor of the speaker, especially when he knows that the man is telling the truth. When you run across hard facts like these you are required to give a good expla-

nation. If you will properly cross-question that man you can get him to answer his own question and give you a satisfactory answer. What has he been doing? Why, he has set for himself a type of animal that he wanted to get, and he has been weeding out everything that did not come up to that standard; he has been breeding from the best and using the best of the offspring; he has been for possibly ten generations right on that line, *and he has got there*. He has produced now what I like to call a thoroughbred. I make a distinction between a pedigreed animal and a thoroughbred, using this latter term for an animal that has been properly bred for several generations until the prepotency that you want has been developed in a high degree.

Now a pedigreed animal may be a thoroughbred in this sense and it may not. If the pedigreed animal has been bred and fed with the same care that our man has used with his grades it has become a thoroughbred, both thoroughbred and pedigreed. If a pedigreed animal has that breeding for several generations, it is a valuable quality, and if a man puts that animal at the head of his herd, he will not be disappointed. But hit and miss breeding can spoil any animal, no matter what its pedigree. What is pedigree? It is merely the history of the animal. Every animal on earth has a pedigree, whether known or unknown, thoroughbred or ordinary, one has a pedigree just as long as the other, reaching back to its first ancestor. The only difference is that in the case of most animals this history is unwritten, while the pedigreed animal has a written history, so that we can look back and find out whether the man that raised those animals bred them properly. If he bred them hit and miss for the sake of getting as many animals as possible on to the record, then they are of no value, in spite of their pedigree.

I think at the present time our farmers are making a mistake—though I am aware my position will be challenged—in putting too young bulls at the head of their herds, not keeping their bulls long enough. I said we could not test the bull as we could the trotting horse, by putting them on the track; but we can test that bull by keeping him long enough and watching the results of his use. Many a time you hear a man say “I would give ten times

what my old bull cost if I could have him back again ; he seemed to nick in just right, he was just what I wanted for my cows." But you say you cannot keep the bull a long time; he gets vicious. That is true, but a bull can be kept for quite a number of years if properly handled. You can find many a bull in every county five or six years old, whose offspring is all right ; he has been tested, he has this power of prepotency, and yet his owner wishes to dispose of him. He may want to change to some other breed, or the bull may be too closely related to the animals in the herd, and he has made up his mind to send him to the butcher. There are lots of these animals that go to the butcher every year that are altogether too valuable to be thus used. You may have to de-horn them, you may have to be pretty careful, you may have to take extra pains that they do not get the better of you ; but you have there the tested animal, you have there the full vigor of the animal. As the sire and dam the one most vigorous is the one most likely to impress its likeness upon its offspring, and a bull five or six years old, in full vigor, well kept, is more likely to give vigorous stock and impress its personality upon the offspring. Instead of changing bullsevery year or two you would better stick to one until you get all the good you can out of him.

Then the question will arise how far you can use him on one herd before there is danger? I will merely say that I should want to inbreed at least twice. The breeding of brother and sister or of father and daughter is once inbreeding. But the breeding of father to daughter and again to granddaughter is twice inbreeding, and if the sire is one you want to use and is not closely related to the other side it is safe. After that you will have to be governed entirely by circumstances. It would take a pretty good breeder to carry it much further than that without getting into trouble.

But the breeding is only a part of the battle. The improvement of dairy cattle is a good deal more than mere breeding. You can spoil the animal by feeding just as easily as you can spoil it by starving. There is one thing that you should keep constantly in mind, you can progress as fast by intelligent feeding as you can by intelligent breeding ; you must feed well to get good results, and



it is surprising how you can develop an animal by correct feeding. We little dream of the possibilities of our cows, if properly fed by the right man.

We have a man in Vermont who says he is almost willing to wager that he can take any cow and get 300 pounds of butter per year from her. Take any cows and give them the best of feed, dried or green, 365 days in the year, and they will make an enormous amount of milk and butter; but they are to be given the right kind of food. If the dairy cow has a tendency for putting her food into her milk, good food will develop her; good food will develop bone and frame, and you will get a large, strong animal, capable of transmitting these same characteristics to her offspring. You cannot do it by stuffing the cow with corn meal, you cannot do it by stuffing the cow with hay, yet those two fodders are the first thing that a man puts into his cow when he says I am going to feed better. He is more apt to use these than anything else. You must take things that build up the frame.

We hear a good deal about economy, about foods that produce the most product per pound. I take it that a ration of equal parts by weight of bran, corn meal and cotton seed meal, is about a perfect ration for getting the greatest product out of the food for a single season. Go out among those who are recognized as the most successful breeders; go into their herds and see if you can find one feeding that ration? Why? Because that ration does not build up the animal, it builds up the milk pail and the butter tub, but it does not build up the animal. You will find many of them discarding cotton seed. I do not think it is correct to say that cotton seed meal has no proper place in the diet of a dairy cow; you will find, however, that those who are most successful in building up a strong animal, discard cotton seed meal and use but little corn meal, putting their faith most largely in what you are in the habit of calling the lighter grains, as bran and middlings.

Most of these light grains contain large amounts of bone and muscle producing material. After you have grown the frame of your cow those same foods will give you the milk. It may be advisable then to give the heavier grains, but you must bear in mind

that you cannot afford to sacrifice the health of the animal for the sake of a few more pounds of milk or butter.

There is one other thing which I am glad to say that farmers are beginning to realize : that feeding must continue 365 days in the year. It is one of the hopeful signs for the dairyman that he is coming to believe that he cannot make a product without good material, that he must feed, and feed grain, all the year round, and in the end he will find that he is well paid for it.

I wish I could say from my own experience that dairymen who pay attention to breeding also pay good attention to selecting ; unfortunately that has not been my experience. Of course you will find that those who are good feeders and good breeders are more apt to be good selectors than those who are hit and miss breeders, but even with the best of breeders not enough attention has been paid to the rigid weeding out and selecting. Right here in the lack of knowledge, is where the trouble comes ; we do not *know* which are the best cows, and until we know that, we do not know which are the proper ones from which to breed.

Our dairy cow is an artificial animal. We have built her up from the wild cow and every step we take upward will naturally make the next step harder. It seems to be hard that nature should work against us ; but it is a fact that the farther we get from the native cow the harder it becomes to do still better. So the better the feeder and the breeder the larger the proportion of animals he will have to weed out. Our cow at the present time is so artificial that if left to herself she will decline in good qualities, and it is only by careful and vigorous selection that we can even hold our own. Of course we must select in the line in which we are working ; we must select towards the type we have set up as our ideal and in putting forth efforts towards that line you will find that many a surprise will await you. You all understand that the animal will show very soon when you begin to feed heavily, whether it is going to use that feed to make milk or beef. You will have no trouble in selecting in line of beef or milk, but in selecting for milk and butter you will find great difficulty. You will find that you cannot feed richness though you can feed quantity. By heavily feeding you will get more

---

butter from a cow, but you cannot tell beforehand whether that increase in the quantity of butter is to come from an increased quantity of milk or from increased richness. When you select, by all means select for the richer quality and not for the quantity. I say that, because it has been found by practice easier to increase the quantity than to increase the quality. If you find that your animal by its nature has increased the quality of its milk, hold on to and retain that increase; you will find that by the use of proper food you can go on and increase the quantity. So bear in mind in breeding to select for rich milk, for quality, rather than quantity.

In closing let me sum up what has been said. Be particularly careful as to the animal you use at the head of the herd. Use a pedigreed animal, but be sure to use a thoroughbred as well as a pedigreed animal. Use the animal as long as you can. There should be at least two inbreedings. Feed well and liberally and finally to secure the animals for the purpose you want, select rigidly, and doing these things I doubt if you will be compelled to say that there is no improvement in your dairy stock.

## PRESERVING THE CORN CROP.

---

BY W. W. COOKE.

In the Mississippi valley corn is raised principally for the grain. The New England farmer has learned that the stalk of the plant has also much feeding value, and he would be counted a poor farmer who paid no attention to the preservation of this part of the plant so as to get out of it its full feeding value. When we expect to use the stalk for fodder we need to plant a different variety from what we would use if the ear alone was desired. Some varieties of corn have a large ear and a small stalk. Such varieties can be planted quite thickly and produce a large amount of grain without drawing very heavily on the land, but when one desires the largest amount of feeding value that can be obtained per acre from his corn land he needs to select a variety that has a large stalk. It is getting quite common for public speakers in given directions concerning any kind of corn, to advise the raising of the largest varieties of corn that will mature in a given locality. It is probable that this advice is not quite correct, and that it would be better to modify it and say, raise the largest variety of corn that will get to the roasting stage in that locality. We had some experience on this point last fall. We used the Sanford and red cob, planting the rows north and south, one-half of the piece to each variety, and then harvesting East and West, so that each load was partly red cob and partly Sanford. At the time of harvesting the red cob was in the full boiling stage, some of the more advanced ears almost glazing, while the Sanford was fully glazed. There were as many bushels of corn per acre on the Sanford as on the red cob possibly a little more, but even after mixing with the red cob there was still too large a proportion of grain. We were not able to feed the ensilage in as large quantities as we desired. In feeding above 40 pounds there was more grain in it than was desirable, and quite a little of the Sanford

was so ripe and hard that it was not digested ; when we attempted to feed from 50 to 60 pounds, as we had in winters past, the cows received an overdose of the grain and became feverish. It would have been more healthy for the cows and more satisfactory as a crop had the entire field been red cob or some other similar variety with more stalk and less ears.

There is great difficulty in making farmers believe that corn for fodder should be planted thinly. Our corn fodder for ensilage is planted in hills three feet apart each way just as early in the spring as we can get into the ground and treated in every way as if we wanted the grain. Corn is a sun loving plant and cannot reach perfection unless it is planted thinly enough to allow light and air to reach to its roots. Planted in this way we have a large stocky plant that reaches maturity. All who have fed immature corn side by side with mature must have noticed the large increase of feeding value per pound of the mature corn. But the objection is made that in this way, that is planted thinly, with a large variety you obtain a heavy stalk like a club that the cows will not eat, and some farmers go so far as to say that it is not fit cattle food. No greater mistake could be made in regard to the feeding value of the corn plant. These great stalks encased in rind so hard that it takes a strong arm to cut it, contains cattle food of the very best quality, in fact next to the grain, the best part of the corn plant. It is true that if the stalks are allowed to dry and then given whole to the cows they will not be eaten up clean, owing to the labor of masticating them, but both by chemical analysis and actual experiment we have found them to have high feeding value. In a thorough test made some years ago we found that pound for pound of dry matter, the butts of these big stalks had rather more feeding value than the tops.

When corn is grown for the ears it is necessary that the crop be well ripened before it is time for frost. He who intends to use his crop for fodder has the large advantage of being able to wait until quite late in the season before harvesting his crop. For either of these uses, but especially for ensilage, a slight frost is of but little injury, and it is possible, therefore, to count on at least two or three weeks more of growing season for the fodder crop

than would be safe for a crop of grain. This allows a much larger growing variety to be used and this last two or three weeks represents the period of the plants highest activity, when it is storing up daily a large amount of the best of food and ensures a gain in the crop of probably twenty per cent.

At the present time our New England farmers are putting a good deal of thought on the question as to what they should do with their fodder corn crop after harvesting, whether it shall be stooked or put in the silo. There are certain well defined cases in which there can be no question as to the more advisable method. A man farming on a small scale with a few cows and very little help, can more profitably stook his corn than put it in the silo. The manual labor of the operation is about the same, but in siloing a large force is required to be working at the same time, necessitating on most farms the hiring of considerable outside help. Stooking, on the other hand, can be done by whatever help is available, from one man with or without a horse, upwards. But the most important difference between the two methods for the beginner is the cost of the outfit. Stooking requires no machinery, no outlay for tools, not even an outlay for so much as a roof to cover, while the silo is itself expensive to build and the machinery for cutting and operating the cutter is expensive at the outset and a source of continual expense for labor.

Stooking is certainly best adapted to small farms ; but those who practice this method usually fail to get as good returns from it as might easily be obtained. The habit has been to stook in small piles as could easily be set up while the corn was being cut with but very little carrying. This is a quick and cheap way of getting the corn in stooks, but it is also a very poor way. These stooks are loose and allow the rain and snow not only to strike the outside but to penetrate even to the innermost stalks and make a very large loss of feeding value. Tests that we have made on such stooks show a very high loss of feeding value, in some cases nearly one-half being lost. These small stooks are sometimes left in the field and brought to the barn as needed. In other cases they are allowed to stand until well dried out and then packed in the mow in the barn or stacked near the barn. In either case the success of the method is quite

uncertain. The weather of New England during the fall months is too damp to allow of the successful drying out of the corn fodder. In the west it is possible for stooked corn to dry out almost as much as New England hay, but it does so at the expense of a good deal of feeding value ; but in New England it would be seldom that more than half the water dried out of the corn fodder.

He who would make the most of his corn fodder should put it up in *large* stooks. The method we practice is as follows: The corn as cut is hauled near the barn, and set up in as large stooks as can conveniently be made, putting from half a ton to a ton in a stook. The tops are then drawn together as tightly as two men with a heavy rope can draw them and secured by bands of strong twine. This makes a covering that sheds the first rains very well, and still is not so tight as to prevent evaporation and cause heating. After two or three weeks the corn will have dried out and shrunk so that it will be necessary to tighten the bands, after that the corn will stand indefinitely with very little loss of feeding value, and come out almost as green the next spring as when put in. The only reason for drawing to the barn before stooking is on account of the labor of breaking out roads to the stooks through the snows of winter if left in the field. This is of course a good deal more labor than putting in small stooks but if the fodder is to be fed to the winter dairy, and it is desired that it last clear over till pasture the next spring, the added benefit will more than pay for the added labor. But to get the most benefit from fodder corn preserved in this way, or from a large variety of fodder corn preserved in any way, it is necessary to run the stalks through the cutter. We have tried all lengths and have come to the conclusion that the finer the better, and we are cutting quarter of an inch. There is no trouble in getting the largest stalk eaten up clean, without any sore mouths when cut this length.

When the corn crop is treated in this way it will be seen that there is not less labor than there is in putting it into a silo, and also the necessity of the expense of horse power and cutter the same as for ensilage. To be sure the labor of cutting is done in the winter when help costs less, but at the same time it actually requires more time and labor to cut up a given quantity of corn

fodder in small amounts at different times than it does to take it from the field and run it directly through the cutter into the silo. It would probably be more accurate to say that the cost of bringing to the barn and stooking or to put it into the silo was about the same, so that the comparison between the two methods is in taking it from the silo on the one hand to feed to the cows, or on the other side bringing it in from the stook, running through the cutter and then feeding. Our men who we have tried both ways have no hesitation in saying that they would much rather feed from the silo than from the stook. It follows, then, that on a larger scale the silo is the cheaper method.

Has it any more advantages? We have made pretty careful experiments to determine the relative feeding values of the two when they are from the same source and both handled in the best manner. We have found the ensilage to be eaten up a little better and with a little more relish and a little cleaner, though it is surprising how well cows will eat fodder that has been well cured. We found that when cows having the same ration of grain and hay were fed all they would eat of either corn fodder or ensilage that a given field of corn would last a little longer as ensilage than as fodder and that it produced a little more milk and butter. Yet these differences were not nearly so large as had been expected and it is probable that the very large increase in yields, that have been reported from farmers who have changed to ensilage from feeding the crop previously as fodder, are due quite largely to the fact that the corn as fodder was not handled at its best and that more waste was allowed than when it was used as ensilage.

The use of the silo is increasing, but is increasing only in connection with winter dairying. The man who runs a summer dairy has little use for the silo. He has use for the corn plant. No better feed can be grown for his cows during the last part of their milking period—from the last of August to Christmas; but one could not afford to go to the expense of a silo for handling the corn crop during this period. Feeding it green from the field until it is struck by the frost, then stooking and feeding from the stook without cutting is undoubtedly the most economical method in the long run for a man with a summer dairy. The silo is the



most advantageous to the winter dairy that is in flush of milk from October till June and is considered as superior to corn fodder for feeding the cows in the late spring or early summer. The last of July we came to the bottom of the silo from which we had been feeding since February. The cows took a good full feed of the ensilage daily until about the middle of May. As pasture became more abundant they gradually fell off but they have still eaten and seemed to enjoy the ensilage even on the flush of pasture feed.

## MAPLE SUGAR.

---

BY W. W. COOKE, AND J. L. HILLS.

The farmers of Vermont are large producers of maple sugar, and an investigation into the manner of handling necessary to secure the government bounty cannot fail to be of practical importance to them. Such an investigation has been in progress at this Station during the past six months and forms the basis for this bulletin. The conclusions arrived at are as follows :—

1. An accurate thermometer is the sugar maker's best guide in determining how to handle his syrup to make a sugar that will draw the bounty.

2. When sap begins to boil, its temperature is about  $218^{\circ}$ ; as it boils down and becomes thicker the temperature at which it boils rises until toward the end it may be  $235^{\circ}$ — $240^{\circ}$  or even as high as  $245^{\circ}$ .

3. If the syrup had nothing in it but sugar and water, at a temperature of  $230^{\circ}$  it would test  $80^{\circ}$ , and at  $253^{\circ}$  it would test  $90^{\circ}$ . A degree means one per cent of sugar.

4. The syrup also contains mineral matter, malate of lime, ("nitre" or "sugar sand") burnt sugar, and toward the end of the season various materials resembling glucose, due to the starting of the buds and the beginning of the summer's growth of the tree.

5. These extra materials at the beginning of the season are about one-sixteenth the weight of the sugar, and increase until in some very poor and black "last run" they may amount to thirty pounds for every hundred pounds of actual sugar present.

6. Hence 100 pounds of a first class syrup boiling at  $228^{\circ}$  instead of containing 80 pounds of sugar, contains about 75 pounds of sugar and enough of the other materials, 5 pounds, to make up the eighty pounds, the other 20 pounds being water.

7. Such a syrup will have to be heated to  $231^{\circ}$  and some more of the water driven off, before it will contain 80 per cent of actual sugar, and to  $243^{\circ}$  to contain 90 per cent sugar.

8. The more the impurities the higher the temperature to which the syrup will have to be heated.

9. To make a sugar testing  $80^{\circ}$  by the polariscope, first run syrup will have to be heated to  $238^{\circ}$ . The general run of good quality syrup through the most of the season will need to be heated to  $235^{\circ}$ , and if it is

---

a little dark to 286°. Toward the latter part of the season the temperature will need to be raised to 288°, and the same should be done at any time when a syrup gets scorched, or for any reason seems to be of poor quality. This is always on supposition that the syrup is stirred until it grains according to the ordinary custom in Vermont, before it is poured into the tubs or pails. If the malate of lime is not removed, these temperatures will need to be raised two degrees.

10. The last run cannot be made into a sugar testing 80°. This is always true after the buds start, and usually the case with the one or two runs next previous.

11. A sugar containing 90 per cent of pure sugar can be made only from the best of syrup in the first half of the season. The syrup to make it will have to be heated to 242°.

12. The syrup that will make 100 pounds of sugar testing 80° and drawing a bounty of \$1.75, will make 88 pounds of sugar testing 90° and drawing a bounty of \$1.76, a loss of 12 pounds of sugar to gain ONE CENT in bounty.

The 90° sugar will need to be sold at a cent a pound higher than the 80° to make up for the loss in weight. Hence:—Do not try to make a 90° sugar for the sake of getting the two cents a pound bounty, unless you have a special market that will pay you at least a cent a pound extra for the hard sugar.

13. A syrup boiling at 219° has a specific gravity of 1.325 and weighs just 11 pounds to the gallon. This will not granulate under ordinary conditions, but at 220° crystals of sugar will begin to form.

14. A syrup weighing 11 pounds to the gallon will, if of good quality, make 8½ pounds of sugar, testing 80° and drawing a bounty of 15 cents, or 7½ pounds of sugar testing 90° and drawing the same bounty.

### SUGAR BOUNTY.

In a tariff bill lately passed by Congress occurs a provision giving a bounty on sugar made in the United States. The section reads as follows :

#### ACT OF OCTOBER 1, 1890.

AN ACT TO REDUCE THE REVENUE AND EQUALIZE DUTIES ON IMPORTS, AND FOR OTHER PURPOSES.

#### SECTION I.

\* \* \* \* \*

#### BOUNTY ON SUGAR.

231. That on and after July first, eighteen hundred and

ninety-one, and until July first, nineteen hundred and five, there shall be paid, from any moneys in the Treasury not otherwise appropriated, under the provisions of section three thousand six hundred and eighty-nine of the Revised Statutes, to the producer of sugar testing not less than ninety degrees by the polariscope, from beets, sorghum, or sugar-cane grown within the United States, or from maple sap produced within the United States, a bounty of two cents per pound; and upon sugar testing less than ninety degrees by the polariscope, and not less than eighty degrees, a bounty of one and three-fourths cents per pound, under such rules and regulations as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe.

#### NOTICES, APPLICATION FOR LICENSE, AND BONDS.

232. The producer of said sugar to be entitled to said bounty shall have first filed prior to July first of each year with the Commissioner of Internal Revenue, a notice of the place of production, with a general description of the machinery, and the methods to be employed by him, with an estimate of the amount of sugar proposed to be produced in the current or next ensuing year, including the number of maple trees to be tapped, and an application for a license to so produce, to be accompanied by a bond in penalty, and with surities to be approved by the Commissioner of Internal Revenue, conditioned that he will faithfully observe all rules and regulations that shall be prescribed for such manufacture and production of sugar.

#### LICENSES.

233. The Commissioner of Internal Revenue, upon receiving the application and bond hereinbefore provided for, shall issue to the applicant a license to produce sugar from sorghum, beets, or sugar-cane grown within the United States, or from maple sap produced within the United States at the place and with the machinery and by the methods described in the application; but said license shall not extend beyond one year from the date thereof.

NO BOUNTY TO BE PAID IN CERTAIN CASES. REGULATIONS  
AND INSPECTION.

234. No bounty shall be paid to any person engaged in refining sugars which have been imported into the United States, or produced in the United States upon which the bounty herein provided for has already been paid or applied for, nor to any person unless he shall have first been licensed as herein provided, and only upon sugar produced by such person from sorghum, beets, or sugar-cane grown within the United States, or from maple sap produced within the United States. The Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall from time to time make all needful rules and regulations for the manufacture of sugar from sorghum, beets, or sugar-cane grown within the United States, or from maple sap produced within the United States, and shall, under the direction of the Secretary of the Treasury, exercise supervision and inspection of the manufacture thereof.

PAYMENT OF BOUNTIES. NO BOUNTY UPON LESS THAN FIVE  
HUNDRED POUNDS.

235. And for the payment of these bounties the Secretary of the Treasury is authorized to draw warrants on the Treasurer of the United States of such sum as will be necessary, which sums shall be certified to him by the Commissioner of Internal Revenue, by whom the bounties shall be disbursed, and no bounty shall be allowed or paid to any person licensed as aforesaid in any one year upon any quantity of sugar less than five hundred pounds.

PENALTIES.

236. That any person who shall knowingly refine or aid in the refining of sugar imported into the United States or upon which the bounty herein provided for has already been paid or applied for, at the place described in the license issued by the Commissioner of Internal Revenue, and any person not entitled to the bounty herein provided for, who shall apply for or receive the same, shall be guilty of a misdemeanor, and upon conviction

thereof, shall pay a fine not exceeding five thousand dollars or be imprisoned for a period not exceeding five years, or both, in the discretion of the Court.

#### CONDITIONS OF THE BOUNTY.

The particular points to be noticed are that the government will pay a bounty of two cents a pound for all sugar testing ninety degrees or over by the polariscope, and a bounty of one and three-fourths cents per pound for sugar testing from eighty to ninety degrees. A degree means one per cent of pure sugar

In order that a farmer get the advantages of this bounty he must have taken out a license before July first of the present year, and he must make at least 500 pounds of sugar which test eighty degrees or over by the polariscope. It makes no difference whether the sugar is sold or consumed at home provided 500 pounds is made which tests over 80°. A bounty will not be paid for syrup in any form, for any sugar made previous to July 1, 1891, for sugar made after July 1, from syrup made before that date, nor for sugar testing less than 80° by the polariscope.

#### INSPECTION.

The methods that will be used by the United States officials in inspecting and sampling have not yet been published, but we have had assurance that the rules will be made so as to allow the farmer to get the full benefits of the bounty with as little trouble and delay as possible. This is particularly true in regard to the sugar from the first runs, and we feel safe in saying that the regulations will be so made and carried out as to allow the sugar-maker *with but little extra trouble and no extra expense to market his early runs at once and get all the benefits of the high prices and still draw the bounty.*

#### CHARACTER OF MAPLE SAP.

The sap from which the maple sugar is obtained is composed of water, sugar, various mineral matters, such as lime, potash, magnesia, iron, etc., and some organic matters in the shape of vegetable acids. These in a state of purity are all colorless. The

sugar of the maple is exactly the same in composition as cane sugar—the ordinary white sugar of commerce—and it is possible by exercising sufficient care in evaporating, by filtering and by decolorizing, to obtain a white maple sugar that cannot be distinguished by any test of the eye, the taste, or the chemist from ordinary white cane sugar. The brown color of the ordinary maple sugar is due to the changes that take place during the boiling down of the sap. In this process the water is driven off and more or less of the sugar is changed by the heat into other forms called glucoses, at the same time becoming browned. This change takes place even when there is no sign or smell of burning and when the syrup does not stick to the pan. It of course takes place much more readily when the syrup is allowed to burn. Unless special care is taken in handling the sap, outside impurities get in, leaves, twigs, dust and especially drippings from the bark and branches of the trees; these all contain coloring matter and help to darken the syrup and resulting sugar.

The sap is purest, that is contains the least amount of matter not sugar, when it first begins to run in the spring; the proportions change but slowly during the first few weeks, but during the latter part of the season the sugar begins to break up from the action of natural laws and becomes changed into very much the same material as is made when it is burned in boiling down. The sugar in the sap is nature's food for the growth of the tree, but this sugar cannot be used so long as it remains in the form of sugar. Before the buds and leaves can make use of it, it must be changed into glucoses, and this is the change that begins to take place as soon as there is the least sign of growth in the spring. The change goes on rapidly and by the time the swelling of the buds becomes visible to the eye a quarter or more of the sugar has become changed. It follows therefore that all maple syrups will contain some glucoses. The amount in the best of syrups is about one per cent, and this amount increases until in the latter part of the season it becomes very large. We have found as high as 13 per cent in a sugar which seemed to be of a pretty fair quality, while in some of the dark black sugars made from the last runs it is probable that nearly one-third of their weight is not real sugar.

### THE POLARISCOPE

The law of Congress says that the amount of sugar as shown by the polariscope is spoken of, the mineral matter, vegetable matter, are not shown by the polariscope, which is determining the amount of actual pure sugar in the substance. Hence, the larger amount there is in the given sample of sugar the more pure sugar present. So many questions have been asked regard to the polariscope that a short description is given. If a ray of light is passed through a tube containing a solution of sugar, the ray of light will be turned to the right or left. If however the tube contains a solution of sugar, the ray of light will be turned to the right or left. The more the light is turned to the right or left the more the light will be turned to the right or left. The analysis is made as follows:

A known weight of sugar is dissolved in water. Certain chemicals are added to the solution to make a clear solution. A tube is placed with this solution and the plate of the instrument is moved so that the ray of light passes directly through the solution. The scale attached to the instrument is so adjusted that the plate had to be moved there can be no doubt that pure sugar there was contained in the original sample. Instruments are quite expensive, costing from \$10 to \$20, but they would be too expensive for the farmer to purchase, and there is no reason nor necessity for doing so, since that will be done by the chemist or the farmer.

### TESTING SYRUP

If the sap contained nothing but the simple matter to tell exactly how to make it or if the impurities present in addition to the sugar it would still be a comparative simple



these impurities is variable from one sugar orchard to another and change very largely from the beginning of the season to the end, requiring different treatment for different times and places, thus increasing largely the difficulties of the case. Since it is not possible for each farmer to have a polariscope and make his own tests to know when his sugar contains 80 per cent of pure sugar, it is necessary to find some other way by which he can arrive at an approximate idea of the amount of sugar present. Two ways have been suggested for determining this point. One by weight and the other by temperature.

#### TESTING WITH THE HYDROMETER.

All sugar makers know that as the sap is boiled down it becomes heavier and heavier, that is a gallon of it weighs more and more, or in technical language its specific gravity becomes greater. This specific gravity is shown by an instrument called the hydrometer or saccharometer, which acts on the same principal as the lactometer, with which most farmers are familiar. The hydrometer is simply a glass bulb, weighted at the bottom so that it will float upright in the syrup, and having a long graduated glass tube at the upper end. When this instrument is put in pure water it sinks nearly to the top of the glass tube to what is marked as the zero point. The heavier the syrup the less this bulb will sink, and the heaviness or strength of the syrup can be told from the amount that the bulb sinks. If the syrup were all sugar without any impurities it would be possible to tell exactly from the bulb how much sugar there was in the syrup, but the other materials present act just as the sugar does to make the solution heavier, so that the amount of the pure sugar present cannot be told directly from the bulb unless we also know the amount of impurities present. Enough experiments have been made at the Station this spring, so that we can give an approximate idea of the amount of sugar in the solution from the reading of the bulb in various syrups from the first run, middle and last runs. The figures for a good quality of early made syrups are given on page 57 of this bulletin, the first three columns being the readings of the three kinds of hydrometers in use, and the fourth line the amount of sugar present. The hy-

drometer is not of much value above 224 too viscid to admit of accurate determinations. The specific gravities given is determined by the Westphal balance.

#### TESTING WITH THE THERMOMETER

The long series of experiments carried us to believe that the sugar-maker can measure the quality of his product by the intelligent use of the thermometer. Too much stress cannot be put on this rate. The ordinary cheap tin thermometer is incorrect and misleading. It will prove a poor instrument. Good thermometers at reasonable prices, the accuracy of which are such that thermometers are for sale by the Vermont Falls, Vt., by the Vermont Maple Sugar Co., Vt., and by L. R. Tabor, Westford, Vt. It is of course to charge the accuracy of any thermometer.

Pure water boils at 212° F. If sugar is present that are ordinarily found in syrup is added, the temperature at which it boils is increased, and the more sugar present the higher the boiling temperature. In solutions of pure sugar it rises to about 1° for every 10 per cent of sugar from the temperature at which the syrup boils. Proportionately the amount of sugar present. If only sugar is present but the pure sugar it would be possible to determine by instance, we know that a pure syrup boiling at 212° contains 10 per cent of sugar, and boiling at 231° contains 70 per cent of sugar, but as was just said in regard to determining specific gravity, the impurities present act on the thermometer in the same way as the sugar, so that when the thermometer reads 221°, we can say there is about 70 pounds of sugar in 100 pounds of syrup, or it may be partly sugar and partly water.

#### METHODS OF ANALYSIS

When it became known that the Benedictine Station was flooded with inquiries concerning the quality of maple sugar, the Benedictine Station was flooded with inquiries concerning the quality of maple sugar.

law, the use of the polariscope and especially how hard the sugar had to be made in order that it should test  $80^{\circ}$  or  $90^{\circ}$ . It was found at once that there were no figures in existence on this latter point. A great deal of work had been done on the sugar cane, sorghum and beet-sugar, but nobody had ever made any experiments with regard to the way maple syrup would have to be handled to make a sugar testing  $80^{\circ}$  by the polariscope. For the past six months this Station has spent a great deal of time in work on this subject.

In the course of the work the Station has handled a great many gallons of syrup from nineteen different sources, in some cases in the sugar bush or at the sugar maker's home, and in others at the Station building, and has made over five hundred analyses.

In general the work was done as follows: From five to six gallons of syrup were sugared off on a stove, samples for exhibition and for analysis, both stirred and unstirred,\* being taken from the boiling syrup as it arrived at various temperatures, usually from  $232^{\circ}$  to  $238^{\circ}$ . Weights, losses on evaporation, losses from stirring and granulation, specific gravities, crystallization and boiling points, etc., were also taken at various times. Except in the matter of taking out samples from the boiling syrup the usual Vermont method of sugaring off was carried out in every case, and there is no reason to believe that in actual work the sugar maker would get any less sugar than we.

#### CHARACTER OF VERMONT MAPLE SYRUP.

The principal thing to be determined in our work here was the amount of impurity that is present or may be present in syrup at different places and different times in the season. We determined this in a great many samples. Sugar bushes were visited in different parts of the State during the sugar season last spring, the samples taken for each degree of increase in temperature from the time the syrup began to get thick until it was taken off from the

\*Unstirred samples were taken as follows: Catch quantities in weighed and corked Erlenmeyer flasks, which were cooled, weighed, dissolved, defecated, made to 500 c. c. polarized and sugar per cent calculated from known weight taken. We found it impossible to subsample in any other way.

fire. These samples were brought to the Station and tested for the amount of pure sugar present. This work was kept up through the whole of the sugar season so that we obtained samples of the early runs, the middle of the season and the last run. In addition to these we obtained quite a number of samples of syrup in quantity and sugared off at the Station, giving us altogether a series of syrup which we think will include the extremes of goodness and badness as they occur in the State. The following tables are fair samples of the different grades :

UNSTIRRED SAMPLES OF MAPLE SYRUP.

A—good sugar, from an early run.

B—Good sugar, from a middle run.

C—Medium sugar, from a middle run.

D—Good sugar, late in the season.

E—Last run.

*Per cent or degrees of Sugar.*

Temperature.	A*	B	C	D	E†
217°	57.9				45.0
218	58.6				
219	60.7				46.6
220	64.2			60.2	49.1
221	66.3				
222	68.7				52.2
223	73.6				
224					56.7
225					
226	73.9	72.8	69.9		
227	75.2	73.8	71.1		
228		74.9	71.8		
229	77.8	76.0			
230	78.1	76.9	72.2		
231		77.9	73.4		
232	79.1	78.9	75.8	73.3	
233	80.4		76.8	73.5	
234	81.3	80.4	78.6	74.5	
235			79.4	75.4	
236			80.5	76.9	
237			81.2	77.6	
238			81.9	78.0	

\*Contained about one per cent of glucoses.

†Contained 18 per cent glucoses and burned at 234°.

It will be noticed that the medium syrup requires a higher temperature before it tests  $80^{\circ}$  than the good article, and the poorer syrup a still higher. In fact the last syrup was so poor that it was not possible to boil it down sufficiently so that it contained 80 per cent of pure sugar. In other words, more than one-fifth of it was impurity, so that if it were possible to expel all the water, a hundred pounds of it would still contain more than 20 pounds of impurity and consequently less than 80 pounds or degrees of pure sugar. From such a syrup no sugar could be made that would draw a bounty.

A good quality of syrup contains in 100 pounds about 4 pounds of solid matter, not sugar, and a good sugar about 6 pounds, i. e. the foreign matter is about one-fifteenth as much as the pure sugar present. Hence, sap contains in 100 pounds from 3 to 5 pounds of sugar and about one-fourth pound of other solid materials. As the sap boils down, little change takes place, except the loss of water, provided the syrup is good and is properly handled, but a poor syrup, or a good syrup poorly treated, will lose sugar as well as water, through the burning or "inverting" of the sugar.

At a temperature of  $230^{\circ}$ – $234^{\circ}$  a moist mushy "tub-sugar" will be made which will drain a good deal of molasses, while at  $240^{\circ}$  and upwards, a very hard, crystalline "cake-sugar" will be obtained. The former will seldom contain eighty and the latter will sometimes contain ninety per cent of sugar.

#### STIRRING OR GRANULATING SUGAR.

The figures given in the previous table are the amounts of sugar contained in the syrup as it was in the evaporator. In the Vermont methods of making sugar when the syrup is supposed to be done enough it is raised from the stove and stirred until the grains of sugar begin to show, usually stirred until it is quite thoroughly grained. During this process the temperature is all the time falling, but at the same time steam is passing off and the syrup is becoming concentrated and therefore contains a higher per cent of sugar. We made a great many determinations how much increase in per cent of sugar there was during this process of stirring but of course no exact figures could be obtained because

the stirring at different times was under for different lengths of time, but the for approximation of the effect of the ord usually performed when the sugar is to b If the sugar is to be caked or granulated longer and the consequent loss of water greater.

A series of tests including analyses after stirring and granulating indicate that on stirring is practically all water. This ed, for the heat being removed all danger The amount of shrinkage varies according but on a working scale probably amount fortieth in stirring and one-twenty-fifth shrinkages of course correspondingly increase over the unstirred material.

PER CENT OF SUGAR

TEMPERATURE.	UNSTIRRED.
232°	78.9
234	80.4
231	76.1
236	81.6
239	82.5
241	83.5
242	83.1
233	77.1
236	76.1
Average.....	79.9

This average of 2° of sugar gained corresponds to about 2° of temperature, 237° unstirred, it will test 80° at about 1

By combining this table with the chart seen that if a first class syrup is stirred, it 80° when it is taken off at a temperature syrup reaches the same point at 234° and can be heated high enough to reach 80°.

the 90° point would be reached in the first class syrup at 242°, and that nothing but the best of syrup is pure enough to make a sugar that will test 90°.

#### TEMPERATURE TO BE EMPLOYED.

From these figures we are enabled to give the following directions to sugar makers:

*To make a sugar testing 80°, a first run syrup should be treated to 230°. The general run of good quality syrup through the most of the season will need to be heated to 235°, and if it is a little dark to 236°. Toward the latter part of the season the temperature will need to be raised to 238°, and the same should be done at any time when the syrup gets scorched or for any reason seems to be of poor quality. These temperatures are on supposition that the syrup is stirred until it grains, according to the ordinary custom in Vermont, before it is poured into the tubs or pails. If the malate of lime is not removed, these temperatures will need to be raised about two degrees. The temperature of 233° mentioned for early run syrup, while it will make a sugar testing 80° and subject to the bounty, will leave the sugar more soft than is desirable for sale on the general market, and it will probably be more satisfactory to heat it to 235°.*

*These directions will in most cases give a sugar that is really a degree or two above 80°, but it is thought best to err for safety on that side.*

#### DRAINED SUGAR.

The statement has already been made that the last runs of syrup will not make a syrup that will test 80°. By boiling such a syrup down to about 235°, stirring it, putting into the tubs, and after a few days turning on the side and letting the molasses drain out, it is possible to get a good quality of sugar that will test a good deal more than 80°. One sample that we treated in this way tested before draining 67° and after draining 89°, while the molasses had about 50 per cent of sugar.

NITRE.

The name of "nitre" or "sugar sand" is given to the malate of lime in maple syrup of malic acid and lime and is found in all variable quantities.

Most sugar makers boil down syrup 100 pounds to the gallon and then let it cool and settle, the syrup being either poured off or strained through cloths to free it from the nitre. In all the figures given above it is supposed that the nitre is removed. If the syrup is done down nearly to sugar leaving the nitre in, it will be necessary to boil it 120° in order to get a sugar testing 80° by the

WILL ORDINARY SUGAR GET THE BOUNTY?

A large number of samples of sugar made by various makers last spring, being in nearly pure sugar as they were in the habit of making. Nearly all of these samples tested over 80° by the hydrometer, over 90°, while one tested as high as 96°, thick and dry white granulated sugar that one would think to be the pure product of the maple tree. It seems probable that most of the sugar made in the early and middle part of the season will receive a bounty of 1½ cents per pound. All good sugar made during the first part of the season will deserve

IS THE HIGHEST BOUNTY DESERVED?

One question often asked is, shall we give pound bounty by making sugar that will yield 100 pounds of sugar testing 80° will make 88 pounds of 90°, provided it is pure enough so that it comes up to that extent. The 100 pounds of 80° sugar is worth \$1.75, and the 88 pounds of 90° sugar is worth \$1.76, or a loss of 12 pounds of sugar for every cent in bounty. It will be necessary to sell



one cent a pound more than the 80° in order to make up for the loss in weight. From these figures it is evident that none can afford to try to get the 2 cents bounty unless they are sure that they have a special market that will pay them enough extra for the hard sugar to make up for the great decrease in quantity.

#### SYRUP-MAKING.

The particular point in making syrup is to get it as thick as possible without having it granulate on standing. The ordinary rule of the maker is to make syrup that shall weigh 11 pounds to the gallon, and we have found by experiment that this custom is exactly right, and that the temperature corresponding to this weight is 219°. That is, if the syrup is taken off from the fire as soon as it shows a temperature of 219° it will weigh exactly 11 pounds to the gallon and will not gain on standing. This is, however, the extreme limit; if the temperature is allowed to get a single degree higher the syrup will granulate. In practice not much of the syrup that is on the market is quite up to this point, most of it being taken off just before it reaches 219°, and large quantities were on the market last spring which boiled at 216°, or even less. It becomes a matter of some commercial value to know the relative amount of sugar in syrups of these different qualities. That is, if a dealer expects to pay a certain amount for syrup weighing a certain amount per gallon, how much less should he pay for syrup weighing less than 11 pounds, and how much for that weighing more than that?

Rules for this have been laid down for cane-sugar syrups\* but the figures have never been before calculated for maple syrups.

\* The rules for cane-sugar syrups will not apply to maple syrups, both on account of the fact that the maple syrup contains some impurities, and also because these impurities have a different effect from the sugar on the boiling temperature. The effect of the sugar and the impurities on the specific gravity seems to be the same; thus a syrup containing 90 per cent of sugar and no impurity will have a specific gravity of 1.485, and one containing 85 per cent sugar and 5 per cent impurity will have the same specific gravity, but while the latter will boil at 238°, the former will not boil until it reaches 253°.

Water has a specific gravity of 1.000. A gallon of it weighs almost exactly eight and a third pounds. Maple syrups are heavier than this and grow heavier as they become more concentrated, and as the sugar percentage increases. There is quite a close relation between the boiling point and the specific gravity or weight of the syrup. In the course of several sugarings off the weight of the syrup at each degree rise in temperature was taken and they were found to be closely uniform, that is to say that at any given boiling temperature all syrups have about the same weight per gallon. The following table shows average specific gravities and weights per gallon for the various temperatures from 215° :

Tempera- ture of Boiling Point.	Degrees Baume Hydro- meter.	Specific gravity.	Degrees Brix Hydro- meter.	Approximate Per Cent or Degrees of Pure Sugar.	Weight Per Gallon. lbs.	Relative Value Per Gallon.
215°	25.0	1.205	44.9	41	10.4	67
216	29.3	1.250	53.1	50	10.4	87
217	32.0	1.279	58.1	54	10.7	90
218	33.9	1.301	61.1	58	10.8	95
219	35.5	1.319	64.9	61	11.0	100
220	36.7	1.333	67.1	63	11.1	103
221	37.8	1.347	69.4	66	11.2	108
222	39.0	1.362	71.4	68	11.4	111
223	39.8	1.372	73.3	70	11.4	115
224	40.6	1.382	74.9	71	11.5	116
225	41.8	1.391	76.2	72	11.6	118
226	42.0	1.400	77.7	73	11.7	120
227	42.6	1.408	78.8	74	11.7	121
228	43.2	1.416	80.0	75	11.8	123
229	43.8	1.424	81.2	76	11.9	124
230	44.3	1.431	82.2	77	11.9	126
231	44.8	1.439	83.0	78	12.0	128
232	45.2	1.445	84.3	79	12.0	129
233	45.6	1.451	85.2	80	12.1	131
234	46.0	1.457	86.0	81	12.1	133
235	46.4	1.463	86.9	82	12.2	134
236	46.8	1.469	87.7	83	12.2	136
237	47.2	1.485	88.6	84	12.3	138
238	47.6	1.481	89.4	85	12.3	139

Degrees Baumé Hydro- meter.	Specific Gravity.	Degrees Brix Hydrometer	Approx- imate Per Cent of Pure Sugar.	Tempera- ture of Boiling Point.	Weight Per Gallon. lbs.	Relative Value Per Gallon.
25	1.205	44.9	41	215.0	10.0	68
26	1.215	46.8	43	215.1	10.1	72
27	1.226	48.7	45	215.3	10.2	75
28	1.236	50.5	47	215.6	10.3	78
29	1.246	52.4	49	215.9	10.4	82
30	1.257	54.3	51	216.2	10.5	85
31	1.268	56.2	53	216.6	10.6	88
32	1.279	58.1	54	217.0	10.7	90
33	1.290	60.0	56	217.4	10.7	93
34	1.302	62.0	58	218.1	10.8	97
35	1.313	63.9	60	218.6	10.9	100
36	1.325	65.8	62	219.5	11.0	103
37	1.337	67.8	64	220.3	11.1	107
38	1.350	69.8	66	221.2	11.2	110
39	1.362	71.8	68	222.0	11.3	113
40	1.374	73.7	70	223.2	11.4	117
41	1.387	75.7	72	224.5	11.6	120
42	1.400	77.7	74	226.0	11.7	123
43	1.415	79.8	75	227.8	11.8	125
44	1.428	81.8	77	229.7	11.9	128
45	1.442	83.9	79	231.8	12.0	132
46	1.457	86.0	81	234.0	12.1	135
47	1.471	88.1	83	236.3	12.3	138
48	1.486	90.2	85	238.7	12.4	142

The per cents of sugar given above are calculated for a fairly good syrup. The relative value in the last column are based on these per cents, but will be nearly the same for all except the poorest of syrups. The relative values is made use of as follows: A weight of 11 pounds per gallon, and 35° Baume is taken as the standard. Dividing the weight of the syrup by 11 gives the number of standard gallons. Multiplying the price that is to be paid for 11 pound syrup by the relative value figure and dividing by 100 gives the price to be paid per standard gallon.

Example: If 75 cents a gallon is to be paid for 11 pound syrup, how much should be paid for 671 pounds of syrup testing 31° by the Baume hydrometer.

$$671 \div 11 = 61 \text{ standard gallons.}$$

$$75 \times 88 \div 100 = 66 \text{ cents per gallon.}$$

$$61 \times 66 = \$41.26, \text{ price to be paid.}$$

## SYRUP OR SUGAR.

In conversing with farmers one question that is frequently asked is this: "Can we afford to make sugar and get a bounty rather than sell our product in the form of syrup?" To determine this point we made a number of experiments to find out the relation existing between syrup and sugar, that is, how much sugar could be made from a gallon of syrup.

As found upon the market the different grades of syrup lose weight unevenly on evaporation as evinced by the following: Two syrups boiling at  $214^{\circ}$ , specific gravity 1.225, weight  $10\frac{1}{4}$  pounds to the gallon, shrank 40 and 42 per cent in boiling to  $240^{\circ}$ . One syrup boiling at  $215^{\circ}$ , specific gravity 1.225, weight  $10\frac{1}{2}$  pounds to the gallon, shrank 25 per cent in boiling to  $238^{\circ}$ . Two syrups boiling at  $217.5^{\circ}$  to  $218^{\circ}$ , specific gravity 1.296, weight 10 4-5 pounds to the gallon, shrank 24 and 22 per cent in boiling to  $246^{\circ}$ . Two syrups boiling at  $219.5^{\circ}$ , specific gravity 1.307, weight 11 pounds to the gallon, shrank 23 per cent in boiling to  $342^{\circ}$ . This simply means that the poorly made, low boiling syrups have more water to lose on evaporation than the better class. This difference disappears when the loss on evaporation is determined on all the syrups from one boiling point. This shrinkage is almost all water. From  $220^{\circ}$  to  $232^{\circ}$  there is carmellizing or destruction and some inversion of the sugar; from  $232^{\circ}$  to  $238^{\circ}$  little or none; from  $238^{\circ}$  upwards the loss of true sugar is quite rapid.

In boiling down the loss in *weight* from degree to degree is uneven, being rapid at first and slower later on. Thermometer and scales work inversely. The scales drop rapidly at first and slowly later, the mercury rises slowly at first and rapidly later. There is then no direct relation between loss in weight and the degree of the thermometer. Generally, however, from  $231^{\circ}$  upwards the loss between each degree is slight and quite uniform, and from  $230^{\circ}$  upwards invariably slight and almost uniform. Below  $231^{\circ}$  it is more uneven, increasingly so in the lower degrees.

Weight of sugar obtained from 100 pounds of syrup weighing

11 pounds to the gallon, when sugared off at different temperatures :

Temperature of sugaring off.	Average weight. lbs.	Highest weight. lbs.	Lowest weight. lbs.
232°	82.7	82.	83.8
233	81.9	80.5	82.8
234	81.2	80.	81.9
235	80.8	79.5	81.6
236	80.5	79.5	81.1
237	80.	79.	80.9
238	79.5	78.5	80.7
239	79.2	78.4	80.3
240	78.7	78.2	79.7
241	78.5	77.9	79.3
242	78.1	77.4	78.9

It will be seen that a gallon of standard syrup weighing 11 pounds will make  $8\frac{1}{2}$  pounds of sugar testing  $80^{\circ}$ , on supposition that the syrup is of the best quality, and will draw a bounty of 15 cents. It will also make  $7\frac{1}{2}$  pounds of sugar testing  $90^{\circ}$  and drawing the same amount of bounty. From these figures it is possible for any one knowing the price he can obtain for syrup and for sugar to determine which will be his best course financially. Thus, if he can get 75 cents a gallon for 11 pound syrup and has to pay 10 cents for the can, the syrup would net him 65 cents a gallon. This made into sugar would give him a bounty of 15 cents so that he would have to sell the sugar for 50 cents or about 6 cents a pound in addition to the value of the package, in order that the sugar should net him as much as the syrup.

If the syrup is not of good enough quality to make a sugar that will draw a bounty, it will still make the  $8\frac{1}{2}$  pounds of sugar but will have to be sold at a higher price to equal the price of the syrup. Thus, in the case given above it would have to be sold for 65 cents, or about  $7\frac{1}{2}$  cents a pound plus the cost of the package, to be equivalent to the value of the syrup at 75 cents a gallon.

#### THE RESULTS OF THE BOUNTY ON MAPLE SUGAR.

About a year ago the Station issued a bulletin urging the sugar makers of the State to take out licenses for the sugar bounty. As

near as can be ascertained, somewhat over otherwise would not have done so, were these and these thousand will as a result the government something over \$13,000 in sugar of the present note is to set forth the results farmers in their endeavors to get the sugar believing that these results are sufficiently so much larger number of our sugar makers next season.

#### THE MAPLE SUGAR INDUSTRY

According to the last census, the production of the spring of 1889 was 14,123,921 pounds worth \$1,081,899, an average of 7 7-10 cents per gallon of maple syrup valued at \$166,957, per gallon.

Considering one gallon of syrup to be equal to one of sugar, gives a total production of 15, value of one and a quarter million dollars. The number of sugar producers in the State was 14,337 of 500 pounds or upward.

#### THE BOUNTY IN 189

Through the kindness of Hon. J. E. Fernald, Internal Revenue for this District, the Station has secured records of the laboratory at Montpelier which have been made and we are thus able to furnish general information in advance of their publication. The records at the present time are complete for the season and afford a sufficient basis for the remainder.

In addition to this the Station sent to those who had taken out a license, a circular containing the following questions: Number of trees tapped; pounds of sugar made; total gallons of

sugar sold to date; average price received per pound; gallons of syrup sold to date; average price received per gallon; price per pound at which rest of sugar could be sold now; price per gallon at which rest of syrup could be sold now; was your sugar sampled for the bounty; what part of an average crop of sugar did you have this year? Answers were received from 1084 persons and so large a number must give a fairly correct basis for estimating the maple sugar crop this year.

From the returns at Montpelier, it appears that 2,328,846 pounds of sugar were weighed and sampled this year for the bounty, of which 82,237 pounds or  $3\frac{1}{2}$  per cent. tested  $90^{\circ}$  or over and is entitled to a bounty of two cents a pound; 1,939,339 pounds, or  $83\frac{1}{2}$  per cent tested from  $80^{\circ}$  to  $90^{\circ}$  and is entitled to a bounty of  $1\frac{1}{2}$  cents a pound, while 307,270 pounds tested under  $80^{\circ}$  and will get no bounty. In general terms then **seven-eighths** of the sugar tested will get the bounty. The law requires that at least 500 pounds testing  $80^{\circ}$  or over shall be produced to get the bounty. In the total quantities given above are included 522 pounds testing  $90^{\circ}$  or over, and 27,306 pounds testing  $80^{\circ}$  to  $90^{\circ}$  that were in quantities of less than 500 pounds per person and hence lose the bounty. So that there remains 81,715 pounds at 2 cents per pound equals \$1,634.30, and 1,612,033 pounds at  $1\frac{1}{2}$  cents per pound equals \$33,460.58, a total bounty for Vermont of **\$35,094.88**.

According to the last census there were 10,099 persons in the State that in 1889 made 500 pounds or over of sugar. The treasury officials had expected that at least one-half of these would apply for the bounty, but as a fact only 2609 took out license papers, thus only a little more than one-fourth of those who could get the bounty took the first steps necessary to obtain it. Many of these did nothing further so that only 1918 actually had sugar weighed and tried to get the bounty.

The 691 who took out licenses but did not present any sugar to be weighed had various reasons; some did not tap their orchards this spring; some did not make 500 pounds; some made syrup instead of sugar; quite a number were misled by the warm spell that occurred in the middle of the sugar season into thinking that

sugaring was over and, as they had not n time, sold what they had without having can be divided into 276 persons or 40 per 500 pounds; 131 or 19 per cent made syr 13 per cent had various reasons, including their orchards; and the remainder, 194 o 500 pounds, but did not try for the boun to the Station. Those who were misled b under this latter head.

Of the 1918 who tried to get the bou 247 failed; these latter being divided int they made less than 500 pounds, and 179 not test 80°. The 1617 who obtained the average \$21.70.

According to the census of 1890 there makers in Vermont who made less than 50 If we estimate that these made on the a there remains 12,640,621 pounds made by makers, an average of 1250 pounds each that practically all of the 2600 persons wh belonged among the ten thousand who ma if this had been an average year they wo 3,150,000 pounds of sugar, and the 1918 v weighed would have made 2,390,000. they did make just about that amount & yield only a 60 per cent of a crop, which tried for the bounty were confined more p producers who in favorable years make 2 sugar. Testing the same thing in anoth duced this year 2,328,000 pounds of sugar cent of a season they would in an average pounds, or 2,020 pounds apiece. In other inducement enough to the *average* Vermo go through the red tape of getting it unle age 2,000 pounds of sugar and expects to



## THE PRESENT SUGAR SEASON.

The returns from 1084 persons showed that they had made 1,368,000 lbs. sugar and 35,000 gals. syrup from 870,000 trees. If a gallon of syrup is considered equivalent to 8 lbs. of sugar, then the total product would equal 1,634,000 lbs. sugar or  $1\frac{7}{8}$  lbs. per tree. If these sugar makers are correct in their belief that the product this year was 6-10 of an average crop, then the average crop of Vermont is 3 1-10 lbs. of sugar per tree.

As showing how rapidly the maple sugar crop gets in the market it may be of interest to note that at the time our record closes, May 28, fifty-six per cent of the sugar made has already been sold, and since much sugar is used on the farm it probably represented fully three-fourths of all that would be sold. Over sixty per cent of the syrup made had been sold at that date.

## RELATIVE PROFIT OF SUGAR AND SYRUP.

According to the census of 1890, the average value of the sugar produced in 1889 was seven and seven-tenths cents a pound, and of the syrup seventy-six and a half cents a gallon. According to exact figures a gallon of good syrup weighing just eleven pounds will make  $8\frac{1}{2}$  pounds of sugar testing 80%. As most farmers make sugar above 80%, it is probable that the ordinary rule of eight pounds of sugar to the gallon of syrup is very close to average practice. Eight pounds of sugar at seven and seven-tenths cents a pound is 61.6 cents and adding the bounty of 14 cents gives 75.6 cents, whereas the average selling price of the syrup was 76.5 a difference of less than a cent a gallon. It can be said then, that at the relative prices of sugar and syrup, the spring of 1889, it made no difference to the farmer on the average whether he made syrup and lost the bounty or made sugar and obtained it. As, however, most farmers must make sugar, rather than syrup, to such, the bounty would be a benefit.

The replies received this spring indicated that much the same state of affairs exists now. The average of over a thousand sugar bushes, representing a total product of 1,370,000 pounds of sugar and 33,000 gallons of syrup, gives a selling price for the sugar

sold previous to June 1, of 75-6 cents a pound a gallon. The average prices current, were 6 $\frac{3}{4}$  cents for sugar and 70 cents for syrup without the bounty would be worth 20 per cent than the same syrup made into sugar and sold at the average, then, those who have made market have fared better than those who made no bounty.

It is evident from these figures that the bounty on cane sugar has had but little effect *this* year. For maple sugar, the average price being but 10 per cent lower than in 1889, while cane sugar has declined 20 cents a pound. The average price of syrup is 10 cents a gallon lower than in 1889. It is probable that the crop has had considerable influence in lowering both sugar and syrup.

Counting the prices on the average this year per pound for sugar and 72 cents a gallon for syrup per cent of that of 1889, the State will get less for its crop this year than at 1889 prices, and if that be true, as it undoubtedly is to free sugar, to the tune of \$46,955 and gained \$34,622, a net loss of over \$12,000 or of several hundred thousand dollars on the sugar.

#### REGULATIONS.

The following regulations, made by the State, show the methods that have been used this year.

Collectors will, upon request, furnish information to producers, and instruct them in the steps necessary to obtaining bounty.

They will sub-divide the districts to make them convenient for applicants for bounty, and station a sugar collector at a convenient point in each sub-division.

They will provide weighers with proper sampling instruments, sample boxes, stencils, and, when necessary, with scales.

They will examine producers' applications and daily records, weighers' returns and chemists' classifications, find the amount due the purchaser, certify the same to the Commissioner of Internal Revenue, and, when received, transmit checks in payment of bounty to the purchasers entitled thereto.

Weighers will see that licensed applicants for bounty make returns at the beginning of the sugar season of all sugar and syrup on hand.

They will, during the sugar season, weigh at their stations, all sugar presented to them, in packages of ten pounds or more, by licensed applicants, and mark each package weighed with the weigher's name, gross weight, tare and net weight.

They will, at the close of the sugar season, beginning on the date designated by the collector, visit each factory in their respective subdivisions, and weigh, mark and record in like manner all the sugar left on hand.

They will make as many sub-divisions of the different lots presented for weighing as there are different kinds of grades in the lot, and draw one sample of three ounces from each sub-division, the sample to be so drawn as to fairly represent the lot and sub-division from which it is taken.

The samples will be put in the boxes provided, covered immediately, and the blank label on the box filled out.

They will receive the producer's record on his premises, at the close of the season, take acknowledgment of the affidavit thereon, and see that it is in due form.

They will receive no fee for taking such acknowledgment, or administering oaths.

They will take care that no fraudulent claims are presented against the government.

Bounty will be paid only to those licensed applicants producing 500 pounds or more, testing at least 80 per cent of pure sugar.

The application must be in the hands of the officers before the first day of July. It will not do to mail it on the 30th of June expecting it to be received.

They must put all sugar upon which bounty is claimed in packages of 10 pounds or more.

They must number the packages  
No. 1.

They must leave covers of packages  
have been drawn.

They must mark each package with 1

They must mark each package before  
to be deducted as tare.

They must not claim bounty on adul

They must not claim bounty on suga  
1891.

Great care was taken at the laborator  
ses and no sample was passed as below 80'  
so by two analyses.

In the matter of sugar inspection and  
the regulations of the Internal Revenue I  
the producer to the utmost extent possibl  
ers were instructed to take a sample for ea  
if one failed to pass bounty, another migh  
of sample package and the time neces  
sampling and analysis favored "drying on  
higher analysis. Indeed, in some cases w  
extra large lots was taken that failed to r  
spectator was sent from Montpelier to divid  
in several samples in the hope that *some*  
above 80°. In other words, *the governme*  
*ple these lots in order thnt it might pay bo*

#### THE BOUNTY IN THE F

The figures presented here show conc  
sugar made in Vermont is of such a qualit  
bounty, and the experience of those wh  
proves that it is worth much more than th  
sary to get it. Two reasons have been ;  
who have not tried to get the bounty ; fir  
sampling for the bounty would interfere v  
as soon as made, and second, that syrup w

sugar. Whether or not the second will be true another spring, it is best to take out the license papers and then the farmer can make sugar or syrup as he pleases when the season opens, and still not lose the bounty if he finally decides to make sugar. In regard to the first, it has been shown this year that there is but little trouble and no expense attending the shipping of the sugar as fast as made and having it weighed and sampled as it is shipped. This has been done in the case of many thousand pounds, and it is fair to presume that with this year's experience to guide them, still better and more convenient arrangements can be made by the revenue officials in the future.

## THE COMPOSITION OF MILK.

BY W. W. COOKE.

The average composition of cows' milk, and the extremes to which the parts may vary, are as follows: Water average 87 per cent, extremes 83 to 90. Total solids, average 13, extremes 10 to 17. Fat, average 4, extreme 2 to 8. Casein, average 3, extremes 2 to 4. Albumen average 0.8, extremes 0.2 to 0.8. Lacto-protein, average 0.1, extremes 0.09 to 0.35. Milk sugar, average 5, extremes 4.5 to 6. Ash, average 0.7, extremes 0.6 to 0.8. Milk contains on the average 0.1 per cent of citric acid. These variations depend on the food, period of lactation and the breed. The extreme limit of variation would not occur in the milk of herds but only in the case of single cows. The fat is the most valuable part of the milk, because that governs the price largely when the milk is to be sold as milk; it is the one valuable part in the milk for butter-making and is the principal value of the milk for cheese-making. Fat is composed of carbon, hydrogen, and oxygen, in the proportions of three-quarters carbon, one-eighth hydrogen and one-eighth oxygen. Fat exists in the form of small globules which can only be seen by the microscope. The size of these globules varies very much, the average being 0.0002 inch, the largest being three times this diameter, and the smallest being only one-third as much. A quart of average milk would contain over a hundred thousand millions of these globules, and a single drop contains over five millions. When we consider their small size we can see how utterly impossible it is for the separator or any other method of handling milk to break up these globules or have any effect on them. The fat in the milk is a compound of several different kinds of fat, the principal of which are olein, stearin, butyrin, and palmitin, and an exceedingly small quantity of four other fats. In the chemical sense of the word, fat is a combination of glycerine, with a fatty acid, and it is the breaking up

of this combination which makes the disagreeable odor when the butter becomes old and rancid. These different fats which combine to make butter have a difference in their degree of hardness.

Thus olein is fluid at ordinary temperatures, while stearin requires a temperature well down to freezing to solidify it. The fat in the milk consists then of two fats, stearin and palmitin, which are ordinarily solid, and one olein, which is ordinarily liquid, these three constituting on the average 91 per cent of the entire fat in the butter. The other fats together contribute but 9 per cent of the entire mass of the butter, yet they form an important part of it, since it is the presence of these which distinguish butter from other animal fats which are composed entirely of palmitin, stearin and olein. The specific gravity of butter fat is about 0.93 at ordinary temperatures. It is therefore about one-fourth lighter than water. The melting point of butter fat (not of butter) varies from  $84^{\circ}$  to  $105^{\circ}$ . Melted butter begins to be solid again at about  $76^{\circ}$ . The composition of butter fat is not constant since the proportions of the different fats are somewhat changeable. It was formerly supposed that green feed made a softer butter than dry, which is another way for saying that the butter contained more olein and less stearin from green feed than it did from dry. This has not been substantiated by late experiments, but it has been proved that different articles of food have a decided effect on the hardness, that is the melting point, of butter fat. This is true particularly of cotton seed meal which produces a butter containing much more stearin and consequently a much harder butter than the average. The particular bearing of this fact is that the higher the melting point the higher the temperature at which the cream must be churned to get perfect separation.

While the milk globules are in the milk they exist in the peculiar condition of being still liquid at a temperature at which they would be solid if they were taken out of the milk and collected into a mass of butter. It is possible for water to exist in the same condition. Thus if water is put in a fine spray on velvet these fine drops may be cooled below the freezing point without turning them to it.

It used to be considered that each of these small globules of butter fat were surrounded with an envelope of casein and that the office of churning was to break this sac, set the fat free and allow it to unite into a mass. Certain experiments have proven conclusively that this is not so, that there is no envelope to the fat globule, and the belief held at the present time is, that the fat globules exercise an attraction on the solids dissolved in the serum and condense them to an envelope on their surface, an envelope which is always to be conceived of as a fluid and yet retains the other milk solids in a concentrated condition.

Next to the fat the albuminoids of milk are most important, both for their feeding value, and also because the presence of one of these, casein, is necessary in cheese making. There are three albuminoids, casein, albumen and lacto-protein. These three are practically the same in chemical composition, but vary a good deal in their general characteristics. The casein is most important and exists in the milk in a very peculiar condition. It is not in a true solution as is the milk sugar, neither is it a solid in exceedingly minute division as is the case with the fat, but it is in a condition between the two. It is neither a solid or a liquid, but is in the condition of a very dilute jelly greatly swollen and distended with water, very much as rubber is when acted on by a large quantity of benzine. When in this condition it can be acted on by rennet, acids and some other substances which coagulate it, that is, cause it to contract and lose some of the water that was united with it, and it may finally be packed together as in cheese so as to hold considerably less than its own weight of water. It has taken a great deal of experimenting to prove that casein does exist in this form, the most conclusive of which is that when milk is filtered through thick plates of earthen-ware, all the milk sugar, the mineral components and the albuminoids are found on one side while the fat and the casein are not able to pass through, so that those first parts are in true solution while the casein and fat are not. Casein is insoluble in dilute acid, and this is the reason it co-agulates or changes to the solid form when the milk sours.

It may be best to consider one of the mineral constituents of the milk in connection with the casein, because the two are



so closely connected in the milk. In fresh milk the phosphate of lime is almost entirely combined with the casein but as the milk begins to sour the first acid that is formed is united with the phosphate and withdraws it from the casein but no curdling takes place till all the phosphoric acid has been withdrawn, when the casein at at once begins to curdle. This fact has an important practical bearing on the question of the proper acidity of milk for churning. Milk begins to sour almost as soon as it is drawn from the cow, but this first souring is not apparent to the taste or smell because it is used up in doing internal work in dissolving the phosphate of lime. It is only after this internal work is all completed that the taste will discern acidity in the milk. When the cream comes to the central churning station from the feeder where it has been obtained by the separator, it has undergone more or less of this change, and to get the best results the butter-maker needs some way of determining how much of this change has already taken place, so as to know at what temperature to set the cream in order that it should be ripened to the proper degree at the intended time for churning. This cannot be determined by smell or taste for the reason already given, but by the use of Prof. Mann's acid test for cream it is possible to ascertain exactly how much of this change has taken place and to learn after a few trials just the way to handle the cream to produce the best results.

A very interesting question comes up in connection with the methods of testing milk and paying for it according to the amount of fat present, whether it is ever possible to produce fat out of casein. It, of course, is not possible to produce casein out of fat, because the casein contains nitrogen and phosphate of lime neither of which exist in fat. But after withdrawing these from the casein, the remaining portions, carbon, hydrogen and oxygen are the same ingredients of which fat is composed. It is a fact that the casein disappears from the milk quite rapidly, and that in eight hours this decrease, when the milk is set in a warm place, may amount to more than 10 per cent. of the casein present. Hence the advisability of making milk up into cheese as soon as possible. This change is due to the action of ferment, but it is not probable that in the short time milk stands before it is made into butter that any such change takes place.

The second of the albuminoids present in the milk is the albumen. It is soluble in water, and exists in the milk in a true solution, but can be precipitated by nitric acid or by boiling the milk. After precipitating it, there still remains the third albuminoid, lacto-protein, which exists in very small quantities, a thousand pounds of milk containing only about a pound of this material. The substance called "Eiger" made in the German cheese factories, which is obtained by heating the whey after adding acid to it, is a mixture of all three of these albuminoids.

Milk sugar is a substance found nowhere else in nature but in milk. It is composed of the same ingredients and in the same proportions as cane sugar, but its behavior shows it to be a distinct substance. The peculiar characteristic is its power to break up into lactic acid.

This change, however, does not take place of itself; thus, for instance, a solution of milk sugar in water might stand at the proper temperature for a great many days before any change would take place; but it is brought about by the bacteria which are commonly known as lactic ferments. If milk is sterilized, that is, heated until these ferments are killed, it may be kept indefinitely without souring, but if to such milk a small quantity of lactic ferment be added, it will begin to sour quite soon and will be curdled within 24 hours. The Boyd Starter is really the inoculation of the fresh cream with the lactic ferment, and the philosophy of it is, the filling of the milk so full of the lactic germs that they will be more numerous and more powerful than the other germs present and produce the lactic change, that is, the souring of the cream, before the other germs present can increase to such numbers as to have any other effect on the cream. The best temperature for the rapid growth of the lactic ferment is from 90° to 95°, and under 50° their growth is very slow. With the increase of heat above 95° their formation is rapidly retarded, and at 115° it ceases. Pasteurizing of milk has recently come into vogue, which consists in warming the milk to 140°, thus killing the germs, and then cooling it rapidly to below their point of activity

before they have a chance to grow in the milk again. In this way milk can be kept from souring for a much longer period than under the ordinary way of handling, and it is probable that within a short time this method will be used to a very large extent, and with excellent results in butter-making creameries. It has been found that the addition of alkalis to the milk in small quantities hastens the souring, while the presence of acids hinders it. Chalk is one of the best substances for hastening the souring of milk. Hence the milk-man who adds chalk to his milk, as is not infrequently done in large cities, is treating the milk in the worst possible way for giving it keeping qualities.

Butyric acid is the particular acid which gives part of the unpleasant odor and taste to rancid butter, and this is formed from the lactic acid after the latter has been produced in the milk. If then the lactic acid and the milk sugar could be washed very thoroughly from the butter so that there could be nothing there from which the butyric acid could be made it could be kept much longer without spoiling.

The mineral parts of the milk consist of potash, soda, lime, magnesia, iron, sulphur, phosphoric acid and chlorine, of which the phosphoric acid and the lime constitute about one-half and the potash about one-quarter.

The variations in the ash of milk both in the entire quantity and particularly in the relative proportions of the various ingredients are very slight. These are the substances which are necessary to the growth of the tissues and especially the bones of the young. A few noteworthy variations in the ash of milk have been determined, for instance, the fact that potash exists in the milk more largely the larger the quantity of milk that is being produced by the cow, and especially the fact that as cows get farther along in lactation, particularly in the latter weeks, there is less phosphate of lime in the milk, which is necessarily accompanied by a less perfect fluidity.

The ingredients so far considered are those most important in the milk. There are other materials which are found with more or less regularity, among which may be noted the milk gas, which is present in the milk when drawn from the cow, and

small quantities of solid matters which appear  
the decomposition of albumen, and also the  
flavoring material which are derived from the

# MILK FERMENTATIONS AND THEIR RELATIONS TO DAIRYING.

---

[Extract from a Bulletin of the Department of Agriculture,  
Washington, D. C.]

In the following pages the word fermentation will be used in its broadest sense. It will include not only the fermentations produced by yeast and rennet, but also all of the numerous destructive changes to which milk is subject, and will cover, therefore, all of the changes which occur in milk, such as curdling, souring, and putrefaction.

## COMPOSITION OF MILK.

It will be necessary at the outset to notice briefly the chemical composition of milk, since upon this are based all of its fermentative changes. While the composition of samples of milk obtained from different cows and produced under different conditions may show wide variation, a fair average composition may be given as follows: Water, 87 per cent, and solids, 13 per cent. The solids include fat, 4.0; casein, 2.6; albumen, 0.7; milk sugar, 5.0, and ash, 0.7 per cent. The casein and albumen are the materials containing nitrogen and are of special importance in cheese making. In general the ash, sugar, and albumen are in solution, the casein in partial solution, and the fat in suspension, being mixed with the milk, but not dissolved in it. Milk when freshly drawn from the cow is a thin liquid, but after standing for a short time becomes viscous or ropy through the formation in it of a small amount of fibrin.

*Milk fat* consists of a mixture of several fats. As its composition begins to undergo changes almost immediately after the milk is drawn, its exact condition at any moment is very uncertain. It

is distributed throughout the milk in the form of minute globules varying in size. The belief that there is an albuminous membrane around the globules which keeps them from combining readily has been abandoned. The whiteness of milk has usually been attributed to the presence of these globules of fat, but is probably due in part to the phosphate of lime which milk contains.

In regard to the nature of the *casein* of milk there has been much discussion. In the first place, it seems certain that casein does not exist in milk in a state of complete solution, but rather in the form of finely divided particles. Probably some of it is in actual solution, while the greater part is in a state of suspension. When milk is filtered through porcelain a clear liquid called milk serum passes through the filter, the casein and fat being left behind. In this serum there is a certain amount of albumen and usually part of the casein also, which has been in solution in the milk; but the fact that most of the casein does not pass the filter shows that it is not in a state of complete solution. The relation of the soluble and insoluble portions of the casein is a matter of much importance in the study of milk fermentations. The coagulation of the casein, or curdling, as the process is commonly called, is readily effected by rennet and also by various chemicals, among which are lead acetate, sulphate of copper, alum, corrosive sublimate, tannic acid, sulphate of magnesium, and the mineral acids, but is not effected by boiling.

The *albumen* of milk is in complete solution and seems to differ only slightly from the serum albumen of the blood. Considering the intimate relation which the milk while in the mammary gland must have with the blood, or rather with the lymph, *i. e.*, the blood deprived of its red corpuscles, it is not surprising to find one of the constituents of milk so similar to this albumen of the blood. We may probably look upon it as derived directly from the albumen of the lymph. The presence of this serum albumen is perhaps an important factor in explaining the changes which take place in milk upon standing.

*Milk sugar* exists in milk in a state of complete solution. It may be obtained by evaporating and crystallizing whey.

The *ash* of milk contains potash, soda, lime, iron, and magnesia, in combination with muriatic, phosphoric, and sulphuric acids, and other constituents. These are all in solution except, perhaps, some of the lime compounds.

Besides the above-mentioned constituents, minute quantities of several other compounds are found in milk, but these have not yet entered into the study of milk fermentations and at present may be neglected. Milk is a very complex body, and a complete study of its fermentations would, of course, take into consideration all of its constituents. At present, however, our knowledge is confined to the study of the fermentations as affecting milk sugar and the casein, albumen, and fat of milk.

#### CAUSES OF FERMENTATION.

The organisms and substances concerned in the fermentation of milk may be divided into two distinct classes, namely, organized and unorganized ferments. The former include the minute living organisms (microorganisms), such as bacteria, yeasts, etc., which by their growth cause changes or fermentation.

The unorganized or chemical ferments, on the other hand, are substances devoid of life which are capable of causing certain chemical changes in other substances without themselves being changed. Rennet and pepsin are familiar examples of unorganized ferments.

Bacteria proper, which have most to do with milk and cream, are found in immense numbers everywhere, and play an important part in nature. They are all extremely minute. In shape they show three chief varieties, which may be compared, respectively, to a lead pencil (*bacillus*), a ball (*coccus*), and a corkscrew (*spirillum*). With the highest powers of the microscope they appear as scarcely more than simple dots and lines. They are to be classed with plants rather than animals, in spite of the fact that many of them are endowed with motion.

The isolation and cultivation of a single kind of bacteria is a matter requiring the greatest care. Although imperfectly studied as yet, many different forms are known which are distinguished

by their habits of growth, the substances in which they thrive, and the changes which they produce in various substances as a result of their growth. Bacteria are cultivated in beef broth, gelatin, and other substances which, when used for these purposes, are called *cultures*. What is known as a *pure culture* contains only one kind of bacteria.

Yeasts are also plants of a low order, which grow very rapidly in certain substances and thus cause changes which are commonly called fermentations. The most common kind of yeast is that used in making beer and raising bread.

#### FERMENTATION OF MILK BY RENNET.

Rennet is a preparation usually made from the stomach of a calf, and has the power of coagulating the casein of milk in a very short time. This curdling of milk by rennet is the only form of fermentation of milk known which is produced by an unorganized ferment.

Many investigations have been made to determine how rennet acts on milk and causes it to curdle. The results are certainly not yet very conclusive nor very satisfactory, but the following general summary may serve to bring together the conclusions which are to be drawn from the facts thus far observed. Casein appears to be kept in partial solution by the alkaline condition of the milk, for it is easily separated from the solution by the presence of a small quantity of acid; but when thus separated it seems to be simply thrown from its solution without being altered in its nature, while the active principle of rennet has a very different effect upon it. Under the action of rennet the casein is chemically changed. It is broken up into two nitrogenous bodies (proteids), one of which is easily coagulated, while the other is coagulated only with great difficulty. The former is readily thrown from its solution by salts of calcium (lime), and since these are always present in the milk, the result of rennet action is always to throw down the curd. This portion of the original casein is then manufactured into cheese, while the other portion, being soluble, goes into the whey and is lost to the cheese-maker. The amount of protein thus lost may



be still further increased through the action of bacteria, which have the power of making even curdled casein soluble, and this fact teaches the advisability of using rennet in a manner which will produce the coagulation as quickly as possible. The rapidity of the action will depend upon the relative amount of rennet and the temperature, and may be lessened by alkalies and increased by various salts. The active principle of rennet is a chemical ferment which is distinct from the other digestive ferments in the stomach juices. It seems to be somewhat widely distributed in nature among animals and plants, and it is a common product of bacteria growth. It is destroyed by a temperature of 158° F., and it acts best at about 95° F. It is undoubtedly to be regarded as one of the digestive ferments.

#### THE SOURING OF MILK.

The normal souring of milk has until quite recently been regarded as a characteristic of milk itself, unassisted by any outside influences. To-day, however, there is such a uniformity of results on the part of all experimenters that it is no longer possible to question the fact that the souring of milk is a fermentative process produced by organisms which get into the milk after the milking is done.

After much investigation bearing upon the subject had been carried on by Pasteur and others, Lister, about 1873, found in milk several forms of bacteria which at first he thought were all of one species, but afterwards found to belong to independent species. It appeared, moreover, that while there is one species of bacteria which produce the lactic acid accompanying the souring of milk, there are others which have different effects. The lactic organism, he determined, is common around the dairy, but not common elsewhere in nature, not even in the barn. He found that sterilized milk, if exposed to the air in different places, in his laboratory, in a barn, or in the open air, or if inoculated with water would ferment after a time, but would not sour; in fact, the souring of milk was found to be rare except in milk which had come directly from the dairy. This somewhat surprising observa-

tion has been confirmed, and hence the conclusion is forced upon us that the lactic organism is peculiar to the dairy, but is not especially abundant elsewhere in nature. Careful experimenters now have no difficulty in obtaining milk free from bacteria.

Later investigations have shown that there are several kinds of bacteria which may cause the souring of milk. It is doubtful, however, whether any two of the organisms of this class act on milk in precisely the same way. It is probable that the decomposition of milk may take place in a number of different ways. While we are certain that the fermentation of milk, commonly known as souring, is caused by bacteria, we have yet much to learn regarding the details of the process.

#### NUMBER OF BACTERIA IN MILK.

These organisms all get into the milk from external sources, such as the air, the hands of the milker, the hair or udder of the cow, and especially from the vessels into which the milk is drawn. It is plain that the number present in the milk will vary with the cleanliness used in the dairy and barn. If the udder of the cow be carefully cleaned and the milk be drawn into a glass tube which, by heating, has been made free from all living germs, and which can be closed so as to keep from the milk all unfiltered air, it is easy to get milk so free from bacteria that it will remain unaffected for two weeks, even though kept all the time in a warm oven.

The number of bacteria present in milk depends chiefly upon the length of time the milk has been standing and upon the temperature. Estimates based upon milk under different conditions have shown them to be almost innumerable. In one instance a specimen of milk which had been standing for four days in a cold place was found to contain about ten millions of bacteria per quart. The same milk was then allowed to stand in a warm room for seven hours, and during this time the bacteria increased a hundredfold. So far as the practical side of this discovery is concerned it only makes more evident the value of keeping milk as cool as possible from the very outset, if we wish to avoid the

troublesome growth of bacteria. For a day or two the bacteria increase with great rapidity, then their multiplication is checked, and finally they entirely cease to grow. This can not, of course, be due to a lack of food, for there is plenty of food in the milk at all times. It is rather to be attributed to the accumulation of the products of their action. Those growths which produce an acid will soon be checked by this, for bacteria can not grow in an acid medium. The amount of acid, however, will vary, for some species of bacteria are very sensitive to acid, while others will endure a larger amount without injury.

#### RELATION OF ELECTRICITY TO THE SOURING OF MILK.

A consideration of the subject of the souring of milk would not be complete without reference to the effect of electricity. The popular belief that thunderstorms will sour milk is so widespread that it would seem as if there must be some foundation for it. It has been asserted by many that the ozone produced in the air by electricity causes the milk to become sour. In experiments in which electric sparks were discharged over the surface of the milk, however, little or no effect has been produced upon it. The conclusion is that electricity is not of itself capable of souring milk or even of materially hastening the process. Nor can the ozone developed during the thunderstorm be looked upon as of any great importance. It seems probable that the connection between the thunderstorm and the souring of the milk is one of a different character. Bacteria certainly grow most rapidly in the warm, sultry conditions which usually precede a thunderstorm, and it frequently happens that the thunderstorm and the souring occur together, not because the thunder has hastened the souring, but rather because the climatic conditions which have brought the storm have at the same time been such as to cause unusually rapid bacteria growth. Milk deprived of bacteria will certainly keep well during thunderstorms. Dairymen find no difficulty in keeping milk if it is cooled immediately after being drawn from the cow and is kept cool. Milk submerged in cool water is not affected by thunder. Dairymen find that during "dog-days"

weather, even when there is no thunder, it is just as difficult to keep milk as it is during thunderstorms; and they also find that scrupulous cleanliness in regard to the milk vessels is the best possible remedy against souring during a thunderstorm. It is safe to conclude, therefore, that in all cases it is the bacteria which sour the milk, and if there seems to be a casual connection between the thunder and the souring it is an indirect one only. Climatic conditions have hastened bacteria growth and have also brought on the thunderstorm. The same conditions would affect the milk in exactly the same way, even though no thunderstorm were produced, and this effect, our dairymen tell us, is frequently observed during the warm, sultry autumn days.

#### OTHER FORMS OF FERMENTATION OF MILK.

Students have not recognized until in recent years that a great variety of fermentations may occur in milk. The reason for the tardiness of this discovery is easily seen. Under ordinary conditions milk always undergoes some sort of lactic fermentation (souring). Only under rare conditions is this absent. The production of lactic acid soon curdles the milk and immediately obscures all other forms of fermentation which have occurred during the process. The acid also stops the growth of all bacteria, so that no subsequent effect can be seen. Hence in normal milk clear evidence of fermentation of any other sort than souring is rarely noticed. But the study of bacteria from the time of the earlier investigations of Pasteur has shown the existence of a large number of species of organisms, and though for a time the fact was disputed, it soon became definitely demonstrated. It became evident, therefore, that with a variety in the species of organisms a variety in the fermentations of milk could be expected. Our knowledge of the newly discovered fermentations is by no means complete as yet. We are beginning to recognize that each species probably has its own distinct effect on milk, and the matter thus becomes very complex. Still we are already able to divide these many varieties of the fermentations of milk into classes, each characterized by a single general action, but comprising many

varieties. The first-class has been noticed, its general characteristic being the production of lactic acid. The second-class is characterized by the production of an alkaline reaction instead of an acid.

#### ALKALINE FERMENTATION OF MILK.

The fermentation of milk is not always accompanied by the production of an acid. It has been ascertained that no lactic acid appears in spontaneously fermenting boiled milk. The milk may become coagulated into a soft, slimy mass, which usually possesses a bitter taste. The taste is never sour, and the milk, instead of having an acid reaction, is either alkaline or neutral. After a day or two the curd begins to dissolve into a somewhat clear liquid, and, if the action is allowed to continue long enough, may become completely dissolved into a semi-transparent liquid having no resemblance to milk. The chemical study of this liquid shows a variety of ingredients, among which are peptones, leucin, tyrosin, and ammonia. To the peptones the bitter taste may be at least partly attributed, and to the ammonia the alkaline reaction.

Many varieties of fermentation are accompanied by the alkaline reaction, but three distinct features of the general class may be conveniently selected for discussion. The formation of butyric acid, the formation of a bitter taste, and the curdling of the milk, with the subsequent dissolving of the curd, are all striking characters which may be considered separately.

#### BUTYRIC ACID.

As early as 1843 the formation of butyric acid in milk was observed, but it was not until 1861 that Pasteur associated this fermentation with a distinct organism. His cultures of it were not pure ones, however, and his results were not satisfactory to us of to-day. But the work was of the utmost value, since it was a departure in a new direction. Pasteur studied the organism enough to discover the very important fact that it grows best out of contact with air.

In 1880 Prazmowski made a careful study of the organism and named it *Bacillus butyricus*. The species described under this name grows rapidly in the absence of oxygen. Boiling will not kill the germs of this butyric organism, and hence milk after boiling will be pretty sure to undergo the butyric fermentation. Its growth in normal milk is not very great for the first few days, nor, indeed, until the milk sugar has been largely turned into lactic acid by the ordinary lactic organisms. The butyric species will certainly grow in sterilized milk, where there is no possibility of the production of lactic acid, but where the growth seems rather to be due to the presence of the oxygen dissolved in the milk.

After the work of Prazmowski others studied the butyric organisms, and their descriptions, which were found to differ considerably, caused much confusion. More recently other species have been found, and the butyric-acid class seems to be as large as the lactic-acid class of organisms. Some of the butyric organisms produce alkaline reactions, while others render the milk acid. In the ordinary handling of the milk this class of organisms is of little importance, but it has been supposed that they have an important effect upon the keeping properties of butter. Rancid butter contains considerable quantities of butyric acid, and the development of the rancidity is simultaneous with the appearance of the butyric acid. When it became known that many species of bacteria produce butyric acid and that there are many bacteria in butter, it was a natural inference that the rancidity is produced by them. But it now appears very doubtful whether bacteria have much to do with the change. Rancidity may be hastened by them, but will occur when they are entirely absent, and is probably of the nature of a direct chemical oxidation closely connected with the agency of sunlight.

#### BITTER MILK.

Out of the general confusion which has surrounded the subject of butyric fermentation have gradually crystallized some definite ideas in regard to the phenomenon known as bitter milk. The milk of old milch cows is said to have a tendency to be bitter,

and various foods which the cow may eat are also thought to have the effect of producing bitter milk. Probably these and other causes may be occasionally at work, but in addition it is certain that microorganisms are frequently the cause of the trouble. At times it is associated with the production of butyric acid, and at other times it is produced by organisms which do not produce butyric acid, but in all cases the bitterness seems to be independent of the acid. Evidently there is quite a number of species which produce this effect. Three have been described with care, and several others incidentally noticed, but we have no means of knowing how numerous they are.

#### ALKALINE CURDLING OF MILK.

One of the common effects of the alkaline bacteria, though by no means a universal one, is the curdling of the milk. The alkaline reaction of the milk proves, of course, that the curdling can not be due to the formation of an acid as in the ordinary souring. From the investigations thus far made we are forced to the conclusion that certain species of bacteria give rise simultaneously to two distinct forms of fermentation in milk, one producing a rennet-like curdling and the other a digestion or dissolving of the casein. So far as is known to-day, the curdling power is always accompanied by a digesting power, but some instances are known in which bacteria have the digesting power without the curdling property.

The curdling of milk by these organisms is very similar to that produced by rennet. In the ordinary handling of milk the class of organisms included under the head of alkaline ferments is of little importance. They grow slowly and the lactic-acid-forming species usually get the start of them, producing their own marked effect on the milk, so that the action of the alkaline species is entirely obscured. Moreover the acid-forming species soon produce so much acid that the growth of all bacteria is checked, and thus the alkaline species have no chance to produce much effect on the milk. At the same time these species are of the greatest importance in dairy products. In the first place many of them form resisting germs which will en-

duce high temperature and render it very difficult to sterilize milk by heat. They are always present in milk which has been standing for a short time, and sometimes their abundance is great enough to produce noticeable effects. Everyone who has had an extended experience with milk has seen instances of milk curdling without the usual acid taste, and it is a familiar fact that curdled milk is by no means constant in character. There is the greatest variety in the stiffness of the curd, the amount of the whey, the taste, odor, etc., and all of these differences are due to varying numbers and species of bacteria other than the lactic-acid class.

Among the numerous species of bacteria affecting milk those producing the rennet-like curdling are abundant, and their share in the ordinary fermentation of milk is not a small one, especially in cool weather. In the keeping property of butter they doubtless play a part, though they are not the sole cause of rancidity. In the ripening of cream for churning their part is still greater, and in the ripening of cheese they are of the utmost importance. Undoubtedly we may trace many of the difficulties of the butter and cheese maker to bacteria of this class. A further knowledge of their action will be of great value to the dairy interest. We are as yet only on the threshold of the study of these organisms, for while the lactic-acid organisms have been quite carefully studied in past years, the rennet-forming class has only recently come into notice.

#### BLUE MILK.

This fermentation, characterized by the deep blue color which has given it its name, occurs sometimes as an isolated trouble in individual dairies, and sometimes it has become so prevalent in certain localities as to be almost an epidemic. The explanation now given for blue milk is a double one. Ordinary milk contains some of the lactic-acid organisms, and these, acting in connection with another species of bacteria known as *Bacillus cyanogenus*, produce the brilliant blue color which characterizes this infection. When growing in ordinary milk the effect of this organism is very marked. For a few hours no change is noticed, but just about the time when the milk begins to become acid some intense blue patches



make their appearance. The faster the acid forms the quicker the coagulation appears and the smaller are the blue patches, while if the acid is produced more slowly the blue patches are larger and of a better color.

Where the blue-milk organism comes from is unknown, nor have we any knowledge of the causes of the occasional epidemics of blue milk. There can be little doubt that the cause is always from some unknown source of filth. In some cases the trouble has been traced to a single cow in a large dairy, and has been easily stopped by isolating the individual found to be the cause, or by carefully washing the cow's teats with a little weak acetic acid solution. Blue milk is always an infection due to outside contamination, and its remedy is always to be found in care and cleanliness. It does not occur in the carefully kept dairy.

Blue milk appears to be harmless. It has been fed to animals, which eat it readily and without harm. Within a few years blue cheese has been brought to the attention of scientists, and has been attributed to the same organism which produces the trouble in milk.

#### ALCOHOLIC FERMENTATION OF MILK.

Milk does not readily undergo alcoholic fermentation. Koumiss, a beverage prepared from mare's milk from time immemorial by the nomadic tribes of Tartary, contains alcohol produced by alcoholic fermentation of milk. Within the last few years this drink has become somewhat common as a beverage for invalids and for that purpose is prepared from cow's milk by adding a little sugar to induce alcoholic fermentation. Another alcoholic drink obtained from milk is the "kefir" of the Caucasus. In both of these beverages the alcoholic fermentations are accompanied by various other fermentations. Within recent years it has been discovered that there are numerous organisms capable of producing an alcoholic fermentation of milk sugar when acting alone. Among these are at least two or three species of yeast. It appears that small amounts of alcohol are produced in some of the common forms of lactic fermentation, and finally we have found that almost any species of yeast can produce alcohol from milk if the process be

first started by adding to the milk a little of the easily fermentable cane sugar. So well known is this alcoholic fermentation to-day that it has recently been suggested that the use of whey in the manufacture of alcohol on a large scale would be a profitable undertaking.

#### SLIMY FERMENTATION.

A slimy fermentation of milk is a somewhat common occurrence and occasionally produces great trouble in dairies. Slimy milk has an important bearing upon the manufacture of Edam cheese. Elsewhere, too, this fermentation is a troublesome one, since it destroys the milk for all ordinary uses. Such milk will furnish no cream. It cannot be churned and is ruined for drinking purposes.

There have been the greatest variety of theories as to the cause of slimy milk. Diseases of the mammary gland, variations in the food of the cow, and differences in conditions surrounding the dairy have all come in for a share in the explanation. But the slimy fermentation of milk has been found to be connected with a large variety of organisms. Some of them give to the milk only a slight sliminess, while others render it tenacious almost beyond belief. One, described by Conn, renders the milk and other solutions so slimy that it can be drawn into threads 10 feet long, and so small as to be hardly visible. Some of the organisms render milk slimy in their early growth, others only after several days, and some do not render the fresh milk slimy at all, but first curdle it and then dissolve the curd into a slimy solution. So far as their chemical side is concerned, the fermentations are also widely different from each other, although not sufficient is known to enable us to classify them all at present.

#### MISCELLANEOUS FORMS OF FERMENTATION.

In addition to the above well-marked classes of fermentation there are various others not so well known or so carefully studied. Among them are some organisms that produce especially striking effects from the production of pigments. Blue milk has already

been noticed, but several other pigment-forming species of bacteria cause milk to turn violet, yellow, green, or red.

Of other miscellaneous forms of fermentation, very little is known beyond the mere fact of their existence. The fact is that milk is an excellent medium for bacteria growth. It furnishes proper food for all of the bacteria connected with decomposition, and the various organisms of the air of the water may grow in it to almost any extent. The study of its fermentative changes resolves itself, therefore, into the study of fermentation in general. Fermentation, decomposition, putrefaction, etc., will all run into each other in the study of the changes occurring in milk, and it is impossible to draw any line separating them. For a complete knowledge of the fermentations of milk, we must wait until we understand thoroughly the process of fermentation and decomposition in general. At present this is an almost unknown field. We can pick out a few of the simpler, more striking types of fermentation and group them into classes as we have done, but we must leave for future study the miscellaneous forms of decomposition and fermentation whose existence we recognize, but of whose nature we are entirely ignorant.

#### PRACTICAL BEARING OF THE SUBJECT UPON DAIRYING.

After this review of the fermentations of milk, the question of their practical bearing forces itself upon our attention. It is becoming more and more evident every year that their bearing upon dairying is of the utmost importance. The practical application of our knowledge of the fermentations of milk will concern each of the three chief dairy products, milk, butter, and cheese.

#### HANDLING MILK.

To those dealing with milk itself in any form, the various fermentations are especially undesirable and are constant sources of trouble. Such persons want the milk pure and sweet, and any of the various forms of fermentation injure the milk for their purposes. Now, so far as these matters are concerned, our study of milk fermentation has taught us first of all *that all fermentations*

*of milk, even the common souring, are due to the contamination of the milk with something from the exterior after it is drawn from the cow.* If they are thus all due to contamination from without, all that is needed to prevent them is to treat the milk in such a way that no such contamination is permitted. But simple as this is in theory our study has shown us that it is a matter of practical impossibility. The various organisms affecting milk are so numerous and so common everywhere that no practical method can be devised for keeping them out of the milk. The person who handles milk must therefore recognize their presence in the milk as inevitable, and he must simply turn his attention to means of reducing them to the smallest number and keeping their growth within the smallest possible compass. This has been shown to be accomplished best by two precautions, absolute cleanliness and low temperatures. The great source of these organisms is in the unclean vessels in which the milk is drawn and in the filth which surrounds the cow. By scrupulous cleanliness in the barn and dairy the number of organisms which get into the milk may be kept comparatively small. The statement of a dairyman that "one should make as careful a toilet for the milking yard as for the supper table" is no exaggeration. Of equal value in preserving milk, is the use of low temperature, and to be of the most use it should be applied *immediately* after the milk is drawn. When drawn from the cow, milk is at a high temperature, and indeed at just the temperature at which most bacteria will grow the most rapidly. Under the influence of the atmospheric temperature, especially in the summer, the milk will become cool very slowly, but never becomes cooler than the air. The bacteria which have gotten into the milk will therefore have the very best opportunity for rapid multiplication and the milk will sour very rapidly. If, however, the milk is cooled to a low temperature immediately after it is drawn, the bacteria growth is checked at once and will not begin again with much rapidity until the milk has become warmed once more. This warming will take place slowly, and therefore the cooled milk will remain sweet many hours longer than that which is not cooled. It frequently happens from this cause that a milkman finds that his morning milk will sour earlier than the milk of the night before.

The milk drawn in the evening is put in a cool place at once and becomes quite cool during the night, while the morning's milk is at once put in cans and taken away for delivery. It will thus happen that the older milk will actually keep longer than the newer milk, simply because it has been cooled and must be warmed before bacteria can begin to grow very rapidly. A practical knowledge of this fact will be of great value to every person handling milk. Early cooling to as low a temperature as is practicable is the best remedy for too rapid souring of milk.

A second lesson of no less importance has been taught. All of the *abnormal* fermentations of milk, such as blue milk, red milk, slimy milk, etc., are also due to the growth of organisms in the milk, and *all of these may be prevented by care*. While the lactic organisms are so common and so abundant as to make it hopeless to try to keep them out of the milk, this is not true of the organisms producing the abnormal fermentations. These organisms are not so abundant, and by the exercise of care they may all be prevented from getting into the milk in such a way as to cause trouble. If a dairy is suddenly troubled with slimy milk or any other abnormal trouble, the dairyman may feel sure that the cause is to be found in some unusual contamination of his milk and that the remedy must be extra cleanliness. He need not look for the cause in the food that the cow has eaten, but may perhaps find it in the hay which the milker has handled or in the dust which has been stirred up in the milking shed. He must look for the trouble in something apart from the cow, and usually in his own carelessness, either in the barn or the dairy. Search in this direction will usually enable him to remove the trouble, while experiments upon the food or conditions of the cow will usually be worthless. Sometimes such troubles may be traced to an individual cow among a large herd. This will of course indicate that this cow has in some way become contaminated with a source of filth which produces the trouble. We must always remember that with a healthy cow all contamination of the milk must come from the outside, and the remedy is seen at once. Such a cow should be cleaned, and especial care should be taken to carefully wash her teats with a weak solution of acetic acid for the purpose of remov-

ing whatever bacteria may be clinging to them. Such methods will soon remove the trouble. The second lesson for the dairyman is, therefore, that *all abnormal fermentations may be prevented by sufficient care and cleanliness.*

It is well to notice that certain abnormal odors and tastes in milk may be produced directly by the food eaten by the cow. If a cow eats garlic or turnip the flavor of the milk is directly affected. Various other foods may in a similar manner affect the taste of milk, but this class of taints may be readily distinguished from those due to bacteria growth. The odors and taints due to the direct influence of the food are at their maximum as soon as the milk is drawn, never increasing afterwards. But the taints due to bacteria growth do not appear at all in the fresh milk, beginning to be noticeable only after the bacteria have had a chance to grow. If, therefore, a dairyman has trouble in his milk, which appears immediately after the milking, he may look for the cause in something that the cow has eaten ; but if the trouble appears after a few hours and then grows rapidly worse until it reaches a maximum, he may be assured that the cause is some form of fermentation and that the remedy is to be sought not in changing the food of the cow but in greater care in the management of the dairy or barn.

Various methods have been devised for destroying the organisms after they have found their way into the milk. Numerous chemicals have been used, and several methods of using heat have been devised. Into the details of this subject we cannot go at present. The methods have been devised for the consumer of the milk rather than the dairyman, and the latter need not concern himself with them. The lessons for the dairyman to learn from the study of the fermentations of milk are scrupulous cleanliness in all affairs relating to milk care in the dairy, thorough washing with boiling water of all milk vessels, and low temperatures applied to the milk immediately after it is drawn from the cow.

#### BUTTER-MAKING.

To the butter-maker the bacteria of milk present a different aspect. To him they prove friends instead of enemies. After the

cream is separated from the milk it proves of advantage to the butter-maker to allow bacteria to grow in it before churning. It is the custom of butter-makers to allow their cream to "sour" or "ripen" for a number of hours before churning. This is accomplished by allowing it to stand in a warm place for twelve to twenty-four hours. During this time the bacteria in it are multiplying rapidly and, of course, producing the first stages of the various forms of fermentation of which they are the cause. Prominent among them will be some of the lactic-acid organisms, and these will produce the souring of the cream. But the changes which occur are not confined to the lactic-acid organisms, for the warm temperature will hasten the growth of various other organisms which happen to be present in the cream.

The butter-maker finds certain advantages in such ripening. He finds that the cream will churn more easily and that he can get a larger amount of butter from a given amount of cream if it is ripened than he could if it were churned while fresh. He finds, further—and this is perhaps the chief value of ripening cream—that the butter made from ripened cream has a flavor superior to that of butter made from sweet cream. To obtain the proper flavor or aroma is one of the chief objects of the butter-maker.

Taking up the last matter first, we notice that the aroma is undoubtedly connected with the decomposition products of the bacteria growth. The volatile acids supposed to give flavor to the butter are not present in fresh milk, but only appear after standing, *i. e.*, after the fermentations have begun. For a time it was thought that the aroma of butter was due to some alcohol-like product formed during the ripening or to the presence of lactic acid itself. In accordance with this last idea lactic acid has been used artificially to ripen cream, but without much success. Of course, after we have learned that microorganisms have been forced to grow in the cream during the ripening, and when we combine this with the facts which we have learned of the fermentation products of microorganisms, we are led to believe that the ripening of cream is a more complicated process than the simple production of lactic acid. The first person to investigate this matter, in the light of modern discoveries, was Storch, a Swedish scientist.

He assumed that the butter aroma was due to the growth of organisms and made a study of the bacteria in butter and cream for the purpose of finding, if possible, the proper species of organism for producing the aroma. After considerable search he finally succeeded in isolating from ripening cream a single bacillus, which seemed to produce the proper butter aroma when it was used in pure culture to ripen cream. Shortly after this Weigmann studied the same phenomén and also succeeded in obtaining cultures of an organism which produced a normal ripening and gave rise to a proper aroma. This ferment is coming into use in some of the creameries in Germany, the claim being made for it that it insures certainty in the result of the ripening process. It has not yet been introduced into this country for practical purposes.

The value of using such a ferment, if it can be supplied in a practical manner, is easily seen. It will introduce improvements into the creameries similar to those introduced into breweries by means of the study of yeasts. In normal butter-making as practiced to-day there is no way of obtaining any control of the bacteria present in the cream. A given specimen of cream will contain a large variety of bacteria. Cohn has shown that there may be a score of different species of bacteria growing in cream which has been collected in the usual way. The butter-maker has no means of regulating this assortment or even of knowing anything about it, but must depend upon what has been brought to him. During the ripening process there will ensue a conflict of the different organisms with each other, and the result will depend upon a variety of circumstances. The result will be influenced by temperature, variety of species, quality of the cream, and length of time of ripening, as well as by the advantage which certain species of organisms may get from an earlier start. In such a conflict it will be a matter of accident if the proper species succeeds in growing rapidly enough to produce its own effect on the cream unhindered by the others. Now it certainly makes a great difference in the product what species of bacteria happen to grow most rapidly. Storch found only a single species that produced the proper aroma, and Cohn has found that cream ripened with improper species of bacteria produces very poor butter.



The proper aroma of butter is a very intangible matter for study. It is not due to the volatile acids, as was formerly supposed, for the butter aroma has been found to be produced in solutions containing no butter fat. Evidently this aroma is in some way connected with the first products of decomposition which are set up in the cream as the result of bacteria growth. But these decomposition products are very numerous and not at all desirable. The bacteria which grow in ripening cream have been found to produce all sorts of disagreeable flavors and tastes in milk or cream if allowed to act unhindered. It seems to be only the first products of the decomposition that have the pleasant flavor, the later stages of the decomposition giving rise to products of a very different character. Too long a ripening results in the production of a butter containing too strong flavors, and one of the difficulties of butter-makers is to determine the right length of time for proper ripening. Indeed, the greatest difficulty which the butter-maker has to meet is in obtaining a uniform product. Proceeding according to rules which his experience has taught him, he can usually obtain a good product; but even the best butter-makers will sometimes fail from causes not explained.

Now, while the trouble is of course not entirely due to difficulties in the ripening, there is no question that this is one of the prominent sources of difficulty. The butter-maker can have no certainty that his cream is supplied with the proper species of bacteria to produce the proper aroma, and can never be sure as to the result of the ripening. If he could be furnished with a ferment for the purpose, as the brewer is furnished with yeast, one of his chief difficulties would be overcome. It is in this direction that experiments are being directed to-day. The bacteriologists have offered the butter-maker in Europe even now a ferment with which to ripen his cream, and by using fresh milk and separating the cream with the centrifugal machine there is nothing to prevent ripening cream with the ferment offered, unhindered by the other organisms which are usually present. But the work as yet is only preliminary. While there has been found a species of bacteria which produces a good result, we do not yet know enough of the effect of the ordinary species of bacteria. We have no knowl-

edge as to whether more than a single species can produce good results, nor do we know whether the species used in creameries in this country and in Europe are one and the same.

The matter of the production of the proper butter aroma as the result of the use of artificial ferments in ripening cream is at present too uncertain for definite conclusions. We may be confident that the flavor of the butter is largely dependent upon the decomposition products of the bacteria that grow in the cream, and we have positive evidence that some organisms will produce much better quality of butter than others. We may hope that the further study of the decomposition products of different organisms and their relation to cream and butter will offer to the butter-maker the solution of this difficult problem in the future. If that occurs we may hope not that the butter-maker will be able to make better butter than the best that is made to-day, but that he will be able to obtain the best product with uniformity; and we may also expect that the creameries which at present make an inferior quality of butter will be able to improve it so as to compete with the best.

As for the other purposes of ripening, it is not possible to say much at present. Evidently the greater ease of churning and the larger product obtained from ripened cream are matters closely related to each other. The simple fact is that fat is more easily collected into masses of sufficient size to be removed mechanically from the buttermilk; but why the ripening makes them thus more easily collected is not yet fully explained. The difficulty of an explanation lies in the fact that we do not know exactly the condition of the fat in the milk.

The treatment of cream for butter-making needs, therefore, to be very different from the treatment of milk and cream for ordinary purposes. The milkman desires his milk to be as free from microorganisms as possible, but the butter-maker uses them and takes pains to cultivate them, but he wants the proper species if the bacteriologist can furnish them. He desires their action on the albuminoids of the milk, which renders the churning easier for him, and he desires still more the early products of their decomposition, which give him the desirable butter aroma.

## CHEESE-MAKING.

If bacteria are desirable allies of the butter-maker, they are absolute necessities to the cheese manufacturer. Without their agency in ripening cream the butter, though it may taste flat, is still usable, but cheese is worthless without them. New cheese is not palatable; it tastes like fresh milk curd and is not at all pleasant. The proper flavor of cheese appears only as a result of a ripening process which is allowed to continue for several weeks or months, the flavor slowly growing stronger all the while.

The ripening of cheese has been conclusively proved to be a matter of the action of microorganisms. In 1875 Cohn first found bacteria in cheese. But it was Duclaux who first connected the ripening with the growth of these organisms. His first paper in 1877 gave the results of a chemical study of the ripening process and showed that it consists chiefly in the transformation of insoluble casein into soluble albuminoids and that the process is associated with the production of several ferments. Three years later he made a study of the bacteria in such cheese and determined that they are very numerous and comprise several species. In general the process of ripening is quite similar to the digestion by the digestive fluids of the stomach and alimentary canal. At this time Duclaux first suggested that certain of the bacteria produces ferments as the result of their growth similar in their characters to the digestive ferments, a discovery which has been well established by later work.

The ripening of cheese was now studied by others, but the most systematic work was done by Adametz. That ripening is due to bacteria growth was proved by this observer by treating fresh cheese with a disinfecting agent, which would prevent bacteria growth without affecting the chemical condition of the cheese. Under these conditions the cheese did not ripen. He also made quantitative estimates of the number of organisms present, finding from 26 to 165 millions per ounce, and this number was found to increase slowly during the ripening process. He also tried to determine whether ripening is due to the combined action of many species of organisms or to a single species. For this purpose he

studied many specimens, and studied the cheese at intervals during the ripening. He found many species of bacteria present, but as the ripening went on one species was found to increase at the expense of the others and was much more abundant at the close of the ripening than any of the others. This species he always found, while the others were more variable, and hence he concluded that this species is the cause of ripening. These results have since been confirmed.

At this point the knowledge of the normal ripening of cheese rests at the present time. But few observations have been made in regard to abnormal ripening. The greatest difficulty that the cheese manufacturer has to contend with lies in this direction. He can not be sure of a uniform product. In spite of all precautions his cheese will sometimes undergo abnormal troubles and become worthless by changes taking place during the ripening process. These troubles have been attributed to every sort of difficulty, including health and condition of the cow, the condition of the barn, the food of the cow, etc. In some cases they have actually been traced to filth connected with the management of the cows. Recent experiments have indicated that the direct result is in all cases to be attributed to the action of abnormal species of microorganisms which get into the milk, and hence have a share in the ripening of the cheese. Certain it is that black cheese, bitter cheese, and cheese flecked with red spots are all thus caused, and several other troublesome infections have with certainty been traced to microorganisms. But while abnormal ripening is undoubtedly due to growth of improper species of organisms, we cannot at present determine how far the variations in the ripening are due to different species of organisms planted in the curd and how far to different conditions of the ripening. Each, doubtless, has its effect, and much further study is needed in this direction.

It is evident that the presence of bacteria in cheese is inevitable. The milk from which it is made always contains them, and when made into cheese part of the bacteria at least will be enclosed in the cheese. Here they find proper conditions for growth. The conditions are not very favorable, it is true, for the density of the cheese prevents ready access of air, and the organisms which re-

quire air for their growth suffer in consequence, except at the surface. The lack of moisture is also doubtless a disadvantage. But in spite of these disadvantages the bacteria grows slowly and soon produce profound chemical changes. They give rise to the peptonizing ferment, which acts upon the casein, rendering it partly soluble. Besides this, they induce numerous other decomposition changes, the total result of which is the production of the rich, delicately flavored cheese for the market. But though many chemical studies have been made of ripening cheese, we are not in condition at the present time to follow the process beyond stating the few salient facts already mentioned. The cheese maker thus forces the bacteria to give him products for which he obtains a high price. Of course, so far as the food value of cheese is concerned, it is the casein and the fat which render cheese valuable, but its market price depends not upon the quantity of the casein, but upon the flavor, and this flavor is supplied by microorganisms. To a certain extent also it is true that the different flavors of different cheeses are due to the action of different species of organisms in the ripening, although we know little in regard to this matter at the present time.

What the practical application of these results will be in the future, it is impossible to say. We have as yet only learned that there is a causal connection between the ripening and the microorganisms, but the conditions affecting their growth, the variety of species which can produce a normal ripening of cheese, whether different species of organisms will produce differently flavored cheeses, whether the cheeses of the markets are due to the different organisms used in the ripening or chiefly to different conditions under which they are grown, are all problems to be settled before any practical results can be expected. But we can confidently predict one result: If we ever succeed in reducing the ripening of cheese to a systematic process and become able to use the proper species of organisms to produce it, we may expect an end of the cases of poisonous cheese of which so many instances are on record. The poisons in these cheeses are due to the growth of mischievous organisms, and will be avoided when we learn to ripen cheese with pure cultures of the proper species of bacteria.

We may then, perhaps, predict a time when both the butter-maker and cheese-maker will separate the cream from fresh milk by a centrifugal machine in as fresh a condition as the milk itself. Then, by adding to the cream an artificial ferment containing the proper bacteria, and then ripening it in a controlled manner, the butter-maker will be able to control his product. Perhaps in the future, by the use of such ferments, each of which will give a different quality of cheese, the dairy interest holds out the hope of uniformity. Then the butter-maker may always make a product of uniform quality, and the cheese-maker will be able in all cases to obtain the quality that he desires.



# INDEX.

---

Act establishing the Board of Agriculture.....	
Addison County,.....	
Addresses by Invited Parties.....	
Addresses by Members of the Board of Agriculture.....	
A Few Thoughts Suggested by the Times, Luncheon.....	
Agriculture, Members of the Board of.....	
Attractions of Vermont.....	
Bacteria.....	
Barbour, Prof. V. G., Highways.....	
Bennington County.....	
Blue Milk.....	
Board of Agriculture, Act Establishing the.....	
Board of Agriculture, Former Members of.....	
Board of Agriculture, Members of.....	
Bounty on Maple Sugar.....	
Breeding Dairy Stock.....	
Brookfield Institute.....	
Business Opportunities in Vermont.....	
Butter Making.....	
Butter Milk.....	
Calais Institute.....	
Caledonia County.....	
Care and Application of Manure, J. O. Sanford.....	
Care of Dairy Cattle, W. W. Cooke.....	
Charlotte Institute.....	
Cheap Lands in Vermont.....	
Cheese Making.....	
Cheese Factories.....	
Chelsea Institute.....	
Chittenden County.....	
Churches of Vermont.....	
Climate of Vermont.....	
Cooke, W. W., Care of Dairy Cattle.....	
Cooke, W. W., Composition of Milk.....	
Cooke, W. W., Improvement of Dairy Cattle.....	
Cooke, W. W., and J. L. Hills, Maple Sugar.....	



	Page.
Cooke, W. W., Preserving the Corn Crop.....	327
Composition of Milk, W. W. Cooke.....	362
Condensed Milk.....	149
Contents, Table of.....	2
Corn, W. W. Cooke.....	327
Corn Fodder and Ensilage.....	28
Counties of Vermont, Description of.....	113
Craftsbury Institute.....	19
Creameries.....	84, 171
Crops.....	39
Crops, Fodder, Rollin C. Smith.....	269
Dairy Cattle, Care of, W. W. Cooke.....	312
Dairy Cattle, Improvement, W. W. Cooke.....	318
Dairy Stock, Breeding.....	19
Dairying.....	42
Dairy Interests of Vermont.....	147
Danville Institute.....	43
Dehorning Cattle, J. R. Walker.....	184
Description of Vermont by Counties.....	113
Enosburgh Falls Institute.....	39, 75
Ensilage and Corn Fodder.....	28
Essex County.....	121
Fair Haven Institute.....	45, 78
Farm, The.....	89
Farming, Intensive, J. O. Sanford.....	275
Feeding Farm Stock.....	54
Fermentations in the Dairy.....	368
Fertility of Vermont.....	107
Fertilization.....	59
Fertilizer Law.....	9
Fish and Game.....	156
Fodder Crops, Rollin C. Smith.....	269
Forestry.....	66
Franklin County.....	126
Fruit Trees.....	203
Game and Fish.....	156
Gardening, Market, W. W. Rawson.....	207
Gould, John, Butter Making.....	22
Gould, John, The Man That Owns the Cow.....	51
Grasses, Dr. E. H. Jenkins.....	227
Grass Crop, D. A. Kneeland.....	188
Grand Isle County.....	129

---

Granite.....  
Greensboro Institute.....  
Growing and Harvesting our Food  
Guildhall Institute.....  
Highways, Prof. V. G. Barbour..  
Hills, J. L. and W. W. Cooke, M  
Horses.....  
Horse Interests of Vermont, E. C.  
Hyde Park Institute.....  
Improvement of Dairy Cattle, W  
Institutes, List of.....  
Institutes, Report of.....  
Intensive Farming, J. O. Sanfor  
Jenkins, Dr. E. H., Grasses.....  
Jones, Prof. L. R., Potato Blight  
Kneeland, D. A., Grass Crop..  
Lamoille County.....  
Lands, Cheap, in Vermont.....  
Law, Fertilizer.....  
Manufactures in Vermont.....  
Manure, Care and Application of  
Maple Sugar.....  
Maple Sugar, W. W. Cooke and J  
Maple Sugar Bounty.....  
Maple Sugar Making, Temperatu  
Maple Sugar Production.....  
Marble.....  
Market Gardening, W. W. Raws  
Meadows and Pastures.....  
Members of the Board of Agricul  
Milk, Blue.....  
Milk, Butter.....  
Milk, Condensed.....  
Milk Fermentations.....  
Minerals.....  
Minerals of Vermont.....  
Mining and Quarrying in Vermoi  
Morrisville Institute.....  
Northrop, G. H., Poultry on the  
Orange County.....  
Orleans County.....  
Pastures and Meadows.....

	Page.
Peck, Luna S., A Few Thoughts Suggested by the Times.....	180
Potatoes.....	77
Poultry.....	78
Poultry on the Farm, G. H. Northrop.....	174
Preserving the Corn Crop, W. W. Cooke.....	327
Progress of Vermont for 1891.....	108
Quarrying and Mining in Vermont.....	98
Rawson, W. W., Market Gardening.....	207
Rennet.....	371
Report of the Secretary.....	13
Resorts, Summer.....	164
Road Making, Prof. V. G. Barbour.....	242
Rutland County.....	139
Ryder, E. C., The Horse Interests of Vermont.....	196
Ryegate Institute.....	35, 83, 89
Sanford, J. O., Care and Application of Manure.....	286
Sanford, J. O., Intensive Farming.....	275
Secretary, Report of the.....	13
Sheep.....	80, 153
Sheep Husbandry, Victor I. Spear.....	294
Slate.....	169, 173
Smith, Rollin C., Growing and Harvesting our Fodder Crops.....	269
Soil of Vermont.....	95
Spear, Victor I., Sheep Husbandry.....	294
Springfield Institute.....	21, 31, 62
Stock, Feeding Farm.....	4
Sugar, Maple.....	333, 71
Summer Resorts.....	164
Swanton Institute.....	34
Syrup and Sugar.....	343, 356
Table of Contents.....	2
Temperatures in Maple Sugar Making.....	346
Troy Institute.....	348
Vermont as a Place to Live in.....	94
Vermont, Attractions.....	16, 92
Vermont, Climate of.....	96
Vermont, Description of, by Counties.....	113
Vermont Manufactures.....	168
Vermont, Poem.....	92
Vermont's Progress for 1891.....	108
Vermont, Situation of.....	94
Vermont, Soil of.....	95

---

	Page.
Vermonters .....	99
Vermonter in Dakota .....	162
Wallingford Institute .....	37, 50, 63
Walker, J. R., Dehorning Cattle .....	184
Washington County .....	141
Water Powers in Vermont .....	97
Westminster Institute .....	22, 51, 56, 64, 72, 85
Weybridge Institute .....	69, 79
Williston Institute .....	56, 91
Wilmington Institute .....	32, 52, 72
Windham County .....	144
Windsor County .....	145





